# FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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## Flight

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### DIARY OF FORTHCOMING EVENTS.

*Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:*

**Nov. 5–13** .. S.M.M.T. Motor Car Exhibition at Olympia and White City

**Nov. 16** ... Entrance Examination for R.A.F. Cadets

**Nov. 17** ... Annual Dinner of Royal Aeronautical Society, Connaught Rooms. Right Hon. Lord Weir of Eastwood in the Chair

**Nov. 18** ... Lecture, "The Problem of the Helicopter," by M. Louis Damblanc, before R.Ae.S., at the Royal Society of Arts, at 5 p.m.

**Dec. 2** ... Lectures, "Airship Piloting," by Major G. H. Scott, C.B.E., A.F.C., "Airship Mooring," by Flight-Lieut. F. L. C. Butcher, before R.Ae.S., at Royal Society of Arts

## EDITORIAL COMMENT

THE assistance which can be rendered by the aeroplane to the newspaper in the rapid transmission of news was once again very aptly illustrated last week in the case of the poison trial at Carmarthen. The *Daily Mail*, by employing a machine belonging to the Instone lines for the use of its photographers, was able to reproduce pictures relating to the trial which could not have been got by any other means to London in time for the next day's issue of the paper. The machine left Carmarthen with the *Mail* photographer on board almost immediately after the last picture had been taken. A dark-room had been fitted up in the aeroplane, and during the 180 miles' flight to Croydon the negatives were developed and prints taken off them, so that when the machine landed at the end of its trip, the pictures were all ready to be sent off to the process block-makers.

**Newspapers and the Aeroplane**

We could have wished that this enterprise had been shown in relation to something rather less morbid in its interest than the Greenwood trial. We are not, however, so much concerned with the question of taste involved, or whether it is really good journalism to "feature," in the way the *Mail* and many other papers do, the most sordid and often repulsive incidents and happenings which are dealt with by the criminal courts. That is a matter for the respective editors and their readers to settle between them. What we are very much interested in is the enterprise shown and the really wonderful results which accrue from it. Carmarthen is by no means an accessible place. The time occupied in covering the 223 miles distance by railway is about six hours by the fastest trains scheduled. Had the *Mail* relied upon the railway its photographer could not have arrived in London until about 6.30 p.m. on the day the pictures were taken. They would have had to be developed and printed after arriving at the office, blocks made, and got on to the machines in time for printing the first edition. It might have been done, but it is not likely a news editor would have taken the risk of waiting to make up his

pictorial pages, and these photographs would not have appeared until next day. As it was, the *Mail* man left Carmarthen by aeroplane at 11.25 a.m. and arrived, as we have said, with his pictures all developed and printed at 1.56 p.m. The lesson is plain to read. Aerial transport is at a manifest advantage over every other form when it comes to such enterprises as this, and must enter more and more into the calculations of the directorates of newspapers which maintain their hold on the reading public by being first with the news. This will be even more so in the future, in view of the rapid progress which is being made in illustrated journalism. The tendency is all to give the news pictorially, and unless and until the transmission of photographs by telegraph becomes a commercial possibility rather than a scientific curiosity, the aeroplane must come into increasing use as a means of getting home with the news. Even if such a process as we have mentioned should become possible, it is doubtful if any time could be saved over aerial transmission when we regard the record achieved in the case under discussion.

**The Air Navigation Bill**

The Air Navigation Bill, which is designed to give effect to the Air Convention signed at Paris over a year ago, is pursuing the more or less even tenor of its way through Parliament. It has passed the House of Lords, and has now got safely through the Committee stage in the Commons. There was very little discussion when it came before the Standing Committee last week. What there was turned principally about the law of aerial trespass. Clause 9 provides that "no action shall lie in respect of trespass or in respect of nuisance by reason only of the flight of aircraft over any property or the ordinary incidents of such flight." An amendment was moved to leave out the words after "trespass" and to substitute others which would give the right of remedy for the improper use of aircraft. Mr. Churchill, however, asked that the clause should be accepted as it stood because, as he pointed out, if the law remained as it is today, it would be possible to have every aerodrome in the country closed by injunction. That, as he said, would have a most disastrous effect on aviation. No doubt a certain amount of inconvenience arose in the neighbourhood of aerodromes, but the same argument might be applied to railway trains and motor-cars. He hoped the annoyance would be abated as machines became better adapted to their purposes, and he looked forward to a silent or comparatively silent machine in the near future.

After discussion, the clause was passed as it stood, and will be thus incorporated in the new Act when it has gone through its ultimate stages in the House. There is no doubt the question of aerial trespass will in the future give rise to a great deal of litigation unless a formula can be found at the very outset for its close definition. The Air Navigation Bill is well drafted for the purpose, but no Act of Parliament was ever so clear and simple withal that the lawyers could not get through, round and over it for their own advantage. Every new thing seems to be regarded by the legal mind from the point of view of new laws and new cases. It has been aptly pointed out that railways are a case in point. They are a comparatively modern institution, and the laws affecting their use could surely have been codified in as simple a manner as possible if it had been left to others than legal draftsmen. As it is, nothing has put more money into the pockets of the lawyers than railway law. In a smaller way the motor-car has suffered at the hands of the law and the lawyers. The Motor Car Act, lawyer-drafted, is the most ambiguous and one-sided of measures, and when we regard it now we cannot help the idea that when it was drafted it was drawn by people who were in a state of uncertainty as to the future of this new locomotion and purposely made the law affecting it temporary and vexatious in order to see how and where the lawyers might benefit, and then, in the light of acquired knowledge, to fasten permanent legislation upon the new transport. It is this that must be watched in connection with air legislation, and we are pleased to see that, initially, the sponsors of the Air Navigation Bill are endeavouring to make it as wide and at the same time as simple as possible.

**Municipal Aerodromes**

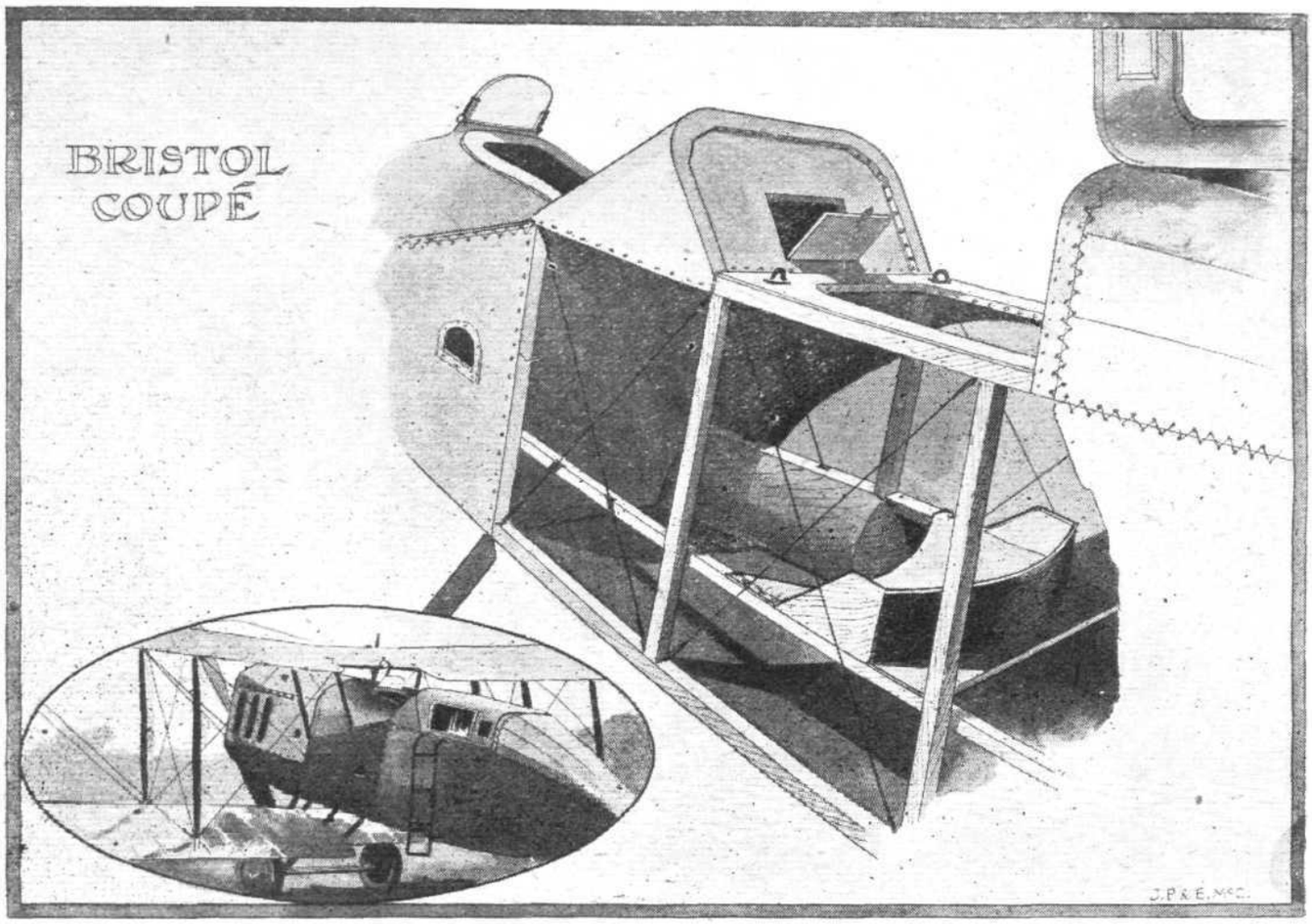
A clause in the Bill which came in for some discussion was the one giving powers to local authorities to acquire land for the construction and maintenance of aerodromes, and it was moved to omit the clause altogether. It was, however, pointed out that the Air Council did not propose that any local authority should run a service, but that they should be able to deal with matters which were ancillary to the carrying on of an aerodrome. The Council already had several applications from big towns with regard to air transport between those places and other centres. In the end the clause was passed as it stood, and as this ended the discussion the Bill was ordered to be reported to the House.

We can understand the anxiety of members of the Committee to prevent local authorities spending the money of the ratepayers in wild-cat schemes for aerial services, and that they should seek to make certain that the objects of the clause are not to invest these authorities with unlimited powers in any such direction. Air services are certainly not within the unhindered province of every local body in the country. They are matters for the most careful and expert thought and provision. Air services, however, are one thing, but the provision of suitable landing grounds and aerodromes is another. In very many places which it is desired to link up with others by air, private enterprise will provide all the landing accommodation necessary, but in others it is quite possible to see that it will be desirable to have such accommodation in the hands of the local authority. In any case, there can be not the very smallest objection to investing these authorities with the power to acquire land for these purposes, subject to the approval of the Air Council.

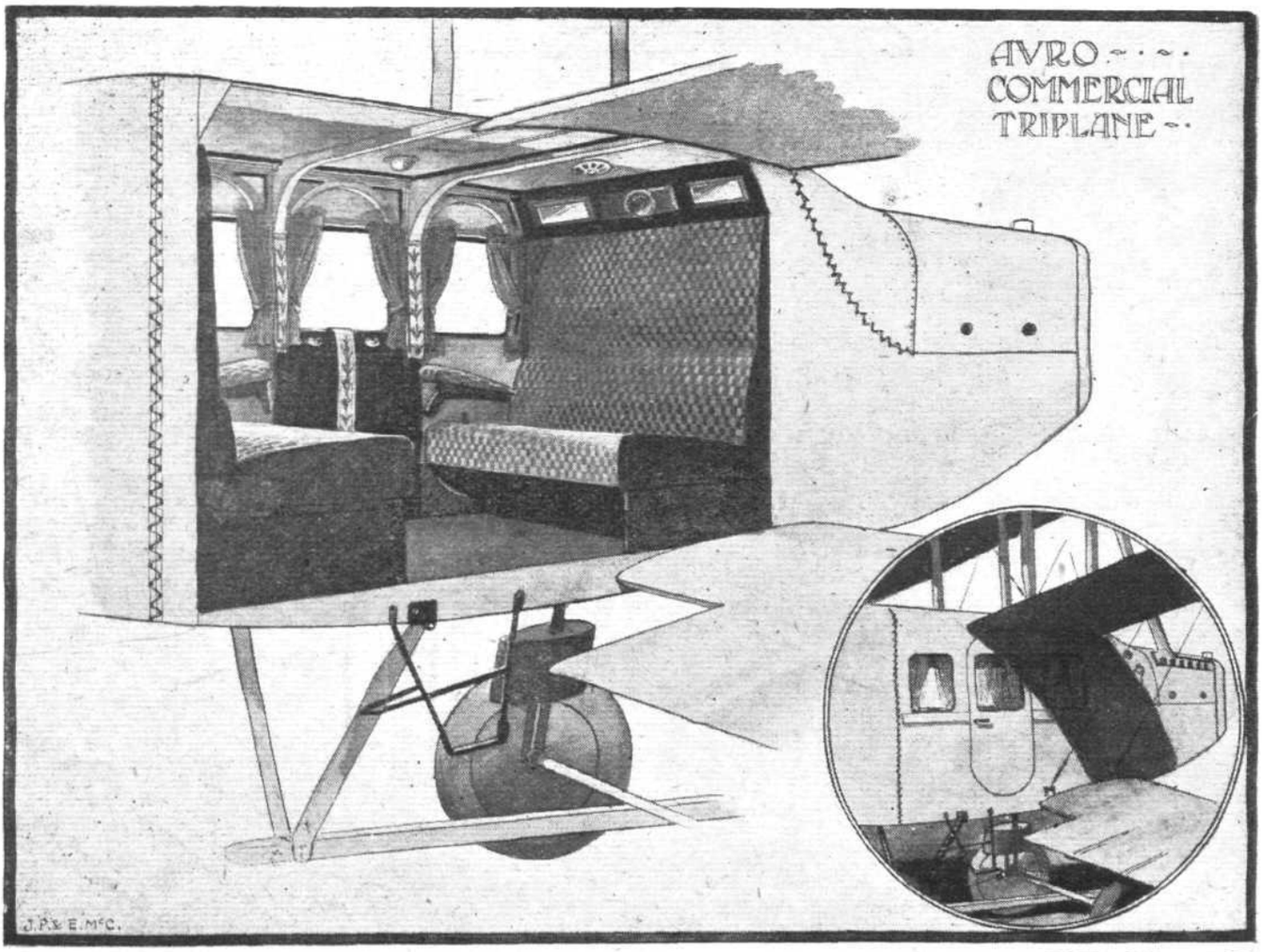
Incidentally to the discussion, a Labour member of the Committee suggested that he would like to see local authorities taking workmen to their work by aeroplane. For nothing? Or, possibly there might be special workmen's tickets at reduced fares! We have a shrewd idea that the first comes nearest the mark.

**Getting Nearer**

The question of the use of the aeroplane as an auxiliary to sea traffic is beginning to engage a large amount of attention. During the War the use of ships as aerodromes was very largely developed. Special types of ship were




MODERN CABIN MACHINES: III. The Bristol Coupé.




MODERN CABIN MACHINES: IV. The Avro Commercial Triplane.

evolved for the purpose of aeroplane-carrying—the *Argus* and *Furious* are cases in point—but apart from that it was found possible to launch land-machines from the turrets of the larger classes of battleship and battle-cruiser. The success attained has again drawn attention to the enlarged use of the aeroplane in connection with ocean-going ships. As is evident, a great deal of time is wasted by vessels in proceeding slowly into ports of call, often for the mere purpose of landing a few bags of mails and an odd passenger or two. The aeroplane could do the work in almost as many minutes as the ship takes hours, and at a manifestly much lower cost.

There seems to be no reason in the world why the idea should not be very widely developed in the future. It would mean certain alterations to the ship's superstructure, it is true, if existing types of land machines were to be used. Whether that is worth while is a matter for the owners to decide, where ships already built are concerned. Without presuming to be dogmatic, we should venture the opinion that the enormous saving in port dues and delay in transit would make it well worth while. In the case of new ships we should say it would certainly pay to design with a view to the utilisation of the aeroplane in the suggested direction. It is, however, to advanced design of the aeroplane itself that we must look for the full development of the idea. At the Air Congress it was distinctly foreshadowed that the helicopter might before very long enter as a practical proposition, and if such should happily turn out to be the case here is the very machine to make the aeroplane the regular tender of the mail steamer. It will be well for both naval architects and aircraft designers to bear in mind the enormous field of usefulness opened up by the suggestion under discussion. We are indeed getting nearer to the realisation of the dreams of a dozen years ago, which visualised an almost universal use of aircraft as aids to commerce.

### The Air League of America

The Americans always try to do things on the grand scale. We should not be inclined to agree that their methods are always much in advance of our own, or that their grandiose manner of projecting national enterprises is always as successful as the promoters hope. There is, however, always to be borne in mind that it is well to aim at the stars. The Air League of America has just formulated a programme of activities which almost takes our breath away by reason of its ambitious intent. It is forming local "Units" and elaborate agreement forms have been printed for signature by those undertaking the formation of these Units. In these forms there is space not only for the names of the officials, but also for no fewer than 37 specific sub-committees, of which each Unit is supposed to form as many as possible. Among these subsidiary committees are separate bodies to deal with aeronautic libraries, military and naval aviation, mails, touring, coastguards, airships, engines, air routes, maps, public safety, night flying, aerial law, insurance, medical instruments, music, aero-astronomy, contests, advertising, public education, and so forth. There is little in the programme that is left wanting, and if the Air League of America can make good on even a quarter of its programme it is bound to carry with its activities an enormous volume of educated public opinion. Obviously, if it can do that it will dominate as a matter of course the whole aerial policy of the United States.

We do not suggest that we really need such an expansive body to look after the interests of the air in this country. Indeed, we are inclined to think that the American body has, to use a common expression, bitten off more than it will be able to chew at present. Still, we could wish that we had here a body with as much enthusiasm and as clear an idea of the need for educating public opinion in aerial policy—and doing it.

### The Glasgow-London Service

IN connection with the projected air service between Glasgow and London under the auspices of Messrs. Wm. Beardmore and Co., an experimental trip was made on November 5. A W.B.2 machine, fitted with 160-h.p. Beardmore engine, piloted by Capt. Ward, late R.A.F., and carrying a passenger and a parcel of the *Glasgow Herald*, left the Renfrew aerodrome at 11.30 and reached Cricklewood, after a non-stop flight, at 4 p.m. The route taken was via Berwick, Newcastle, York and Lincoln; during the latter part of the journey the weather was very misty.

### Aeronautics at Scottish Universities

FOR the first time some of the Scottish Universities are including aeronautics in their Engineering course this year. At Gilmorehill, in Glasgow, what is known as a "half-graduation" course of 12 lectures will be given, the course having been mapped out in collaboration with the Scottish Branch of the Royal Aeronautical Society. Mr. L. Bartlett, of the Royal Corps of Naval Constructors, who is at present stationed at the Inchinnan Airship Works of Messrs. William Beardmore and Co., Ltd., has undertaken lectures dealing particularly with rigid airships. He will deliver two lectures, illustrated by lantern slides, in Glasgow, two in Edinburgh, and one in Dundee, on the subject of "Rigid Airships—Design and Construction."

### Lieut.-Col. Dunville's New Post

IT is announced that Lieut.-Col. John D. Dunville, R.A.F., the well-known balloonist and member of the Royal Aero Club Committee, has been appointed to command the special constabulary in Belfast.

### King Albert Goes Home by Air

ACCEPTING an invitation to visit the Tours aerodrome, King Albert of Belgium decided to break his journey home there on November 3, and after inspecting the camp, mounted a machine, and flew to Le Bourget. There he transferred into his own machine, piloted by Crombez, and continued the journey to Brussels. His aide-de-camp, General Delaagen, was a passenger on an escorting machine.

### De Romanet Breaks Records

THE speed duel between De Romanet and Sadi Lecointe continues and the former now holds the record. On the morning of November 4 at Buc he flew over the kilometre course his average time for the distance in both directions being 11.65 secs., representing a speed of 309.012 kiloms. (192 miles) per hour. In one of his trials he covered the kilom. in 11.2 secs., representing a speed of 321.428 k.p.h. Lecointe's record was 302.052 k.p.h.

The machine was the Spad, fitted with Hispano-Suiza motor and Lumiere propeller, which de Romanet flew in the Gordon-Bennett, with minor modifications. Thus the pilot was all but covered in, so much so that he could see practically nothing straight ahead but only laterally. A slightly larger fin had been fitted, which is said to have increased the directional stability considerably. The engine used was a 300 h.p. Hispano-Suiza, the compression of which had been consideraly raised. No figures are available as to the landing speed of the machine, but that this was very high will be gathered when it is mentioned that the loading of the machine was about 15½ lbs. square ft. In order to beat this record it will be necessary to fly at 313.012 kilometres per hour (194 m.p.h.) Who will be the first to touch 200 m.p.h. ?

### The Blériot Mammoth up for Nearly Two Hours

THE latest four-engined Blériot Mammoth made an extended trial at Buc on November 3. Piloted by Jean Casale it went up to 2,700 metres and flew around for nearly two hours. Casale was accompanied by his mechanic Smith, and the machine carried a load of 3,600 kilogrammes, which with the weight of the machine made a total load of 8,600 kilogs.

FLIGHT
The Aircraft Engineer Airships

# Enter Czechoslovakia

HAVING at last, after many years of suppression, obtained her freedom, the ancient country of Bohemia is now, as the Czechoslovak Republic, making every effort to re-establish that position to which she is entitled amongst the important European nations. A step in the right direction is the inclusion in their programme of reconstruction of what appears to be a sound aviation policy, and already they have a young aviation industry ready for expansion. Prior to 1914 this industry was practically non-existent—the only aviation work done being an occasional offshoot of some motor-car firm—and although during the War there was a certain amount of progress made, after the War the new republic was left without inheritance in the way of an established aviation industry, but had to start and build up a new industry of its own from the very beginning. During the Autumn of last year the Association of Czech pilots arranged a small exhibition and flying meeting with the object of obtaining information and for propaganda purposes. Since that time the progress made in aviation has been such as to warrant the holding the First Czech International Aero Exhibition at Prague.

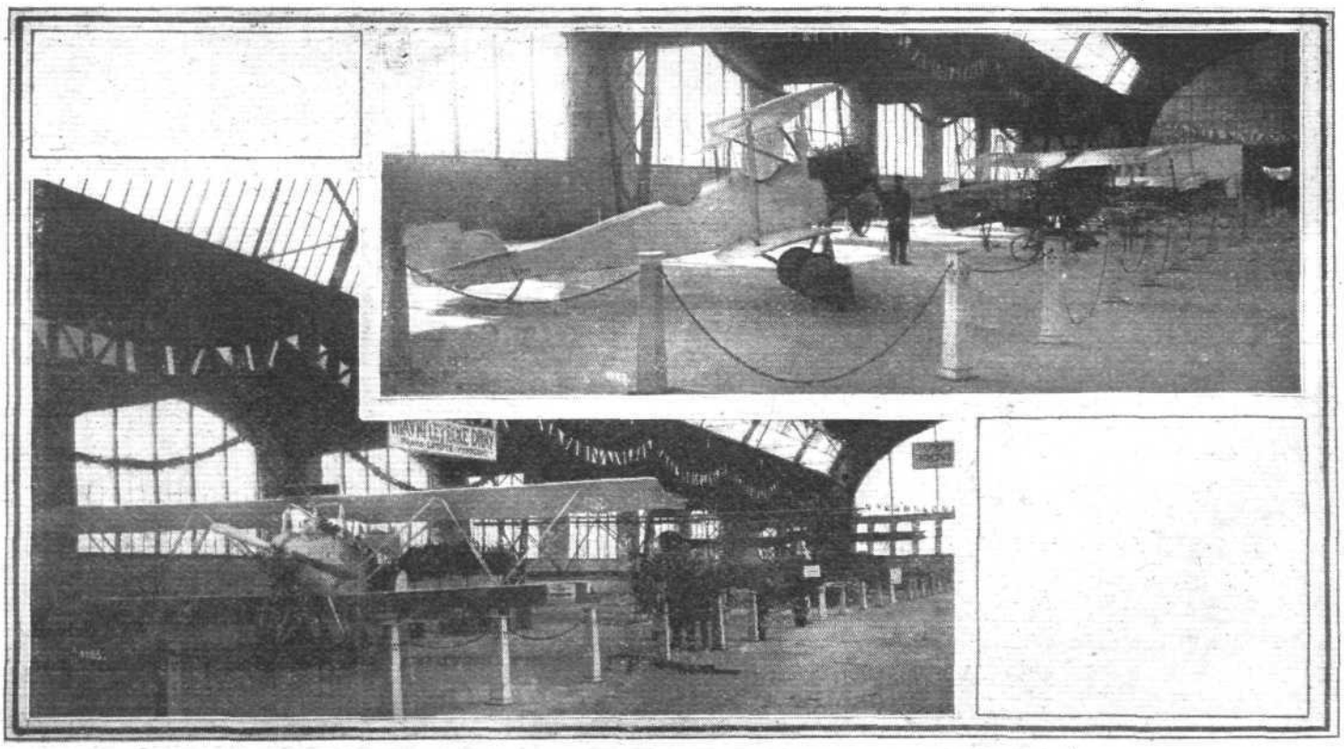
This exhibition was inaugurated by the Czechoslovak Aviation Club—a member of the International Aeronautical Federation—under the auspices of the President of the Republic, Dr. T. G. Masaryk, and was held in the beautiful Industrial Palace (Permanent Exhibition) at Prague, from October 23rd to November 7th. Although the exhibition had received a grant from the Ministry of National Defence—which also placed at its disposal some military aeroplanes—and the Ministry of Railways granted free delivery of exhibits, the powers that be did not expect any great business to result, but looked upon this first exhibition in the way of national propaganda, and as a means of drawing attention to the favourable geographical position of Prague as a centre of aviation in Europe. In addition to the official help given, referred to above, many private individuals, advocates of aviation, gave financial support, with the result that this first aeronautical exhibition was not only a success, but one of which the new republic may justly be proud. It is almost certain to be the means of giving a considerable impetus to this country's new industry.

The most interesting feature of this exhibition consisted of the preponderance of "home-made" exhibits, both in complete machines and accessories. In fact, it is almost incredible that during the short existence of the Republic such progress in aviation could have been achieved, and can only be explained by the national zeal and enthusiasm shown by all concerned. It should not be long, therefore, before the present position of civilian aviation in Czechoslovakia, in having to depend mostly on aeroplanes built abroad, is changed for one of a more self-supporting character. The following is a list of the exhibits displayed in the exhibition :—

1. Engineering Works, formerly Breitfeld Daněk and Co., Ltd., Karlin, Prague :—Drawings, photos., parts of motors, and a complete motor of 230 h.p.

2. "Falco" Aviation Enterprise, Prague :—Complete aeroplane of Brandenburg type, 145 h.p., for transport purposes, and various small parts.

3. "Avia" Association for Repairing and Building of



**THE FIRST CZECH INTERNATIONAL AERO EXHIBITION AT PRAGUE : Two sections of the exhibition. At the top the "Bohemia" B.5 two-seater 40 h.p. sporting biplane, and the C.Ae.C.'s historical section. Below, the Central Aircraft Works' "Sm." machines**


The First Czech International Aero Exhibition at Prague: The Avia "B.H." 35 h.p. sporting monoplane. Note the thick, tapering wings

Aeroplanes, Prague:—Experimental "B.H." (Benès-Hajn) monoplane of 35 h.p.; compressed air motors.

4. Aviation Association "Bohemia," Prague:—Two-seater sporting biplane, type B.5, 40 h.p.

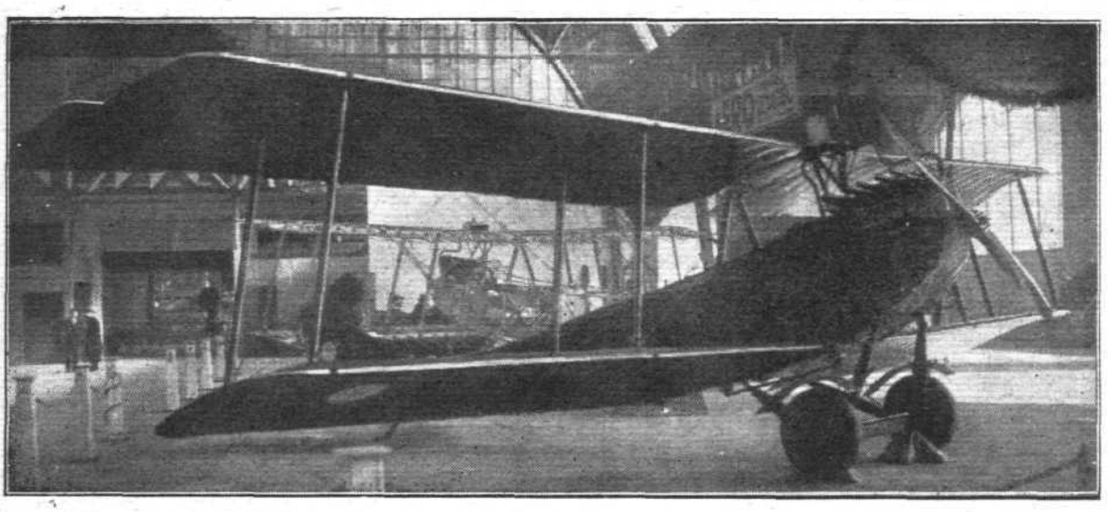
5. Kraffer and Sons, Technical Institute, Prague:—Representing the Glacier Metal Co., Ltd., London.

6. J. Svoboda and Co., Prague:—Helmets, gloves, coats, etc.

9. "Ikarus" First Czech Aviation Enterprise:—Two-seater Brandenburg biplane (165 h.p. Mercédès), fitted up as limousine.

10. Auto-Moto-Aero-Central, Prague:—Various instruments and accessories.

11. Czechoslovakian State Meteorological Institute, Prague:—Instruments for atmospheric measurements, diagrams, etc.; an extremely complete collection of exhibits.



The First Czech International Aero Exhibition at Prague: The "Aero" Co.'s two-seater tractor biplane

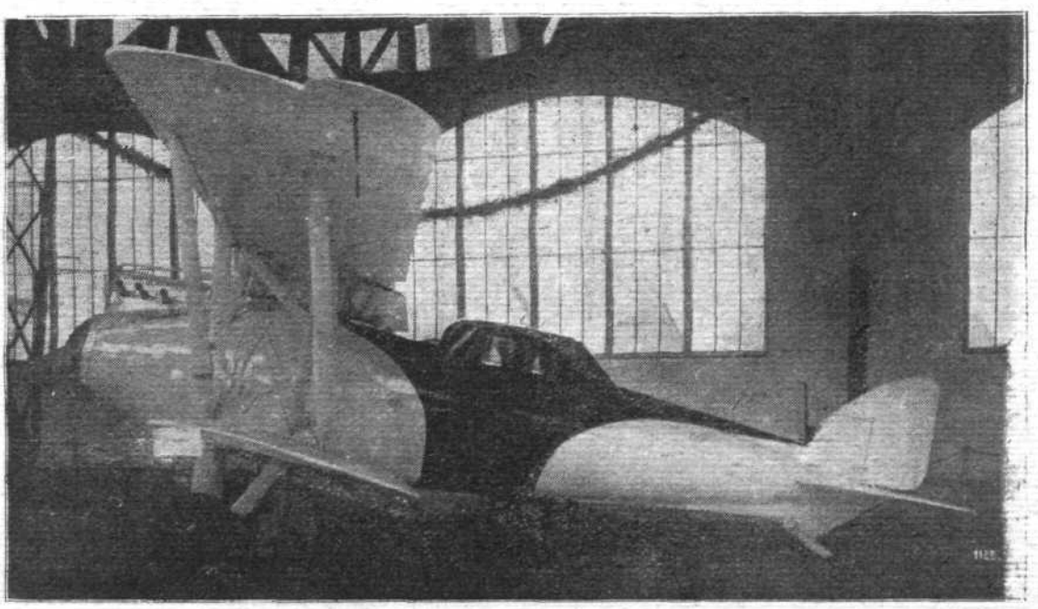
7. Central Aircraft Works, Kbely:—One limousine Šm. biplane, a *fuselage*, two wings, aero motors (Mercédès 100 h.p., Mercédès 160 h.p., Austro-Daimler 160 h.p., and parts of motors of other makes).

8. "Aero" Works for Construction of Aeroplanes, Prague:—Aeroplanes, propellers, various parts, measuring instruments, diagrams, etc.

12. Czech-slovakian Aviation Club, Prague:—Historical aeroplanes of Blériot type, various models, diagrams, maps, etc.

13. West Bohemian Aviation Club in Plzen:—Models, rotary motors of Urban construction, etc.

14. Moravian Aero Club in Brno:—A biplane glider, the property of the Club, constructed by R. Harabus; span



The First Czech International Aero Exhibition at Prague: The *limousine* biplane exhibited by the "Central-Aircraft-Works"

6 metres, length 4 metres, wing area 12 sq. metres. Monoplane glider "Valette"; span 7.5 metres, length 4.6 metres, wing area 15 sq. metres, weight 27 kg. and many other models, etc.

15. Technical Museum, Prague :—Historical documents relating to aviation in Czechoslovakia.

16. Ministry of National Defence :—Complete Voisin, Salmson, L.V.9, Spad and Breguet aeroplanes.

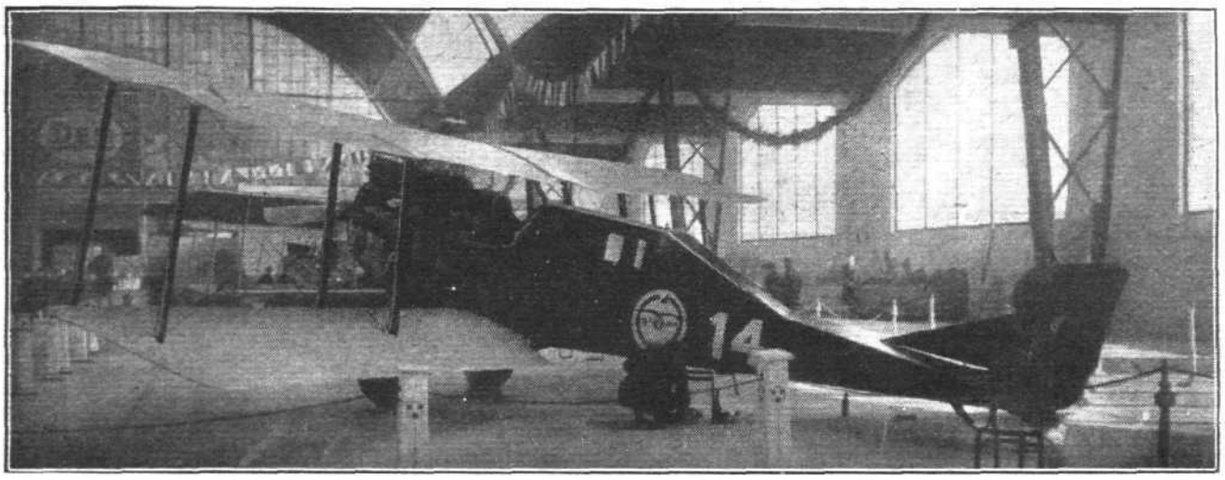
17. Bohemian Association for Refinery of Petrol, in Kolin : —Exhibits petrol and oils.

18. Vladimir Helmhacker :—Printing frames.

19. Exhibition of Inventions, aero photos., particularly flying photos. taken in Siberia.

seemed to give entire satisfaction. These machines were not at the Show.

The Central Aircraft Works of Constructor Šmolik are in Kbely, near Prague, and it is claimed that the "Šm." machines were the first of Czechoslovakian construction. The "Šm." is a biplane with Warren strutting, and having a well-streamlined *fuselage* of elliptical section. It has a factor of safety of 8, and is fitted with a 230 h.p. Hiero engine manufactured by Breitfeld Daněk. The maximum speed is 195 km. p.h., and the climb, with full load, 1,000 m. in 3 mins. 50 secs.; it has a ceiling of 5,500 m. It weighs with full military equipment 1,360 kg The latest model is of the limousine type, having a comfortable cabin for two passengers.



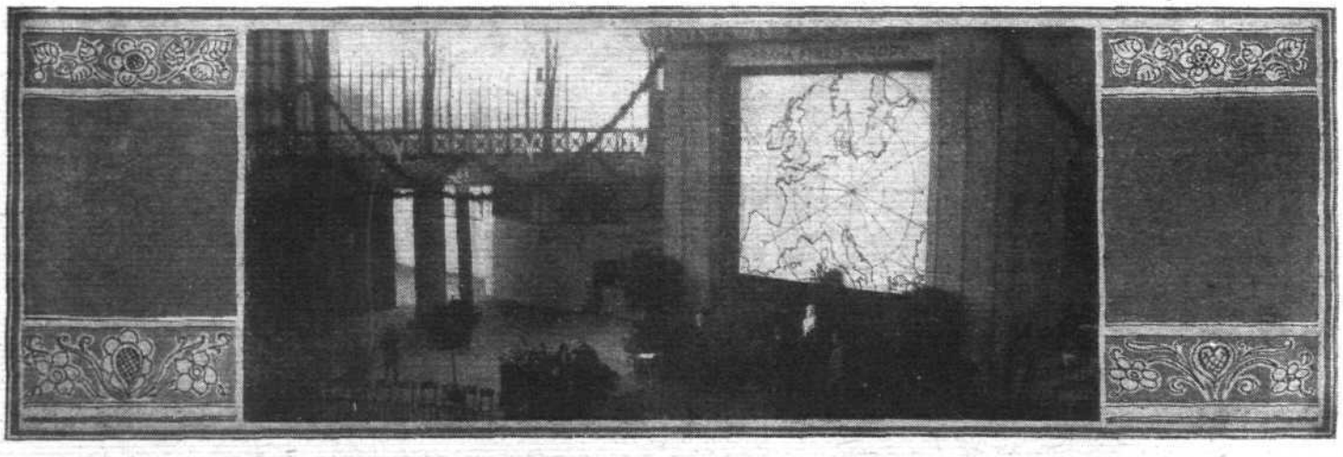
**THE FIRST CZECH INTERNATIONAL AERO EXHIBITION AT PRAGUE : The "Ikarus" limousine biplane, Brandenburg type**

The following notes regarding some of the above firms and machines may be of interest :—

The "Bohemia" Sporting Aeroplane, which is known as B.5, has already achieved numerous flights. It is a two-seater with dual control, and is therefore also useful for school purposes. It is a biplane, with a single pair of struts aside. The span is 8.00 m., length 6.68 m., area 18 sq. metres, motor 40 h.p., the weight empty is 340 kg. and with two passengers and petrol for 3 hours 520 kg. Speed is 100 km. an hour, and climb is 1,500 m. It achieved flight of 110 kilometres in one hour.

The "Aero Aviation Works" was formed in January, 1919, with a capital of 300,000 k. Their works are at Bubenec, near Prague, and the first work undertaken there was mostly repairs of machines of Austrian origin. The equipment was mostly purchased in auction sales abroad. The firm devotes itself to military machines, and is planning aeroplanes with 100 h.p. Mercédès engines and dual control, for school work. This aeroplane is known as "Ae. 10." When the Ministry of National Defence placed its orders with this firm, it was necessary to acquire the works of the existing German firm "A l-Ma" to cope with orders. The firm constructed single-seater scouts and also two-seater battle-planes, which

The "Avia" B.H. aeroplane is the most individual of Czechoslovakian construction. The engineers, Pavel Beněs and Miroslav Hajn, have been working for years on aerodynamic problems, both practical and theoretical, and although some people seem to have been sceptical of their enterprise, those who knew placed the highest confidence in the work of this firm. The aeroplane is a monoplane, the wings being attached to the bottom of the *fuselage* by means of hinges to facilitate dismantling. The wings are practically cantilevers, supported from above by four slanting struts. Throughout the construction full attention has been given to the reduction of head resistance. The wings are of thick section, and taper both toward the tip and root. The factor of safety of the wings is 12. Only wood and three-ply is used in the construction, and the number of cross-members and other constructional parts has been kept down to the lowest possible figure. At the present it has been necessary to use rather a heavy motor for such a small machine. This motor, giving 35 h.p. at 1,350 revs., and 40 h.p. at 1,450 revs. per min., weighs 110 kg. The normal carrying capacity of the machine. is 120 kg., and the weight of the fully-loaded machine is 385 kg., wing area 10.6 sq. m., loading 36.3 kg. per sq. m. It is a single-seater, but there is provision for a passenger.



**THE FIRST CZECH INTERNATIONAL AERO EXHIBITION AT PRAGUE : President Masaryk opens the Exhibition. Note the map of Europe, showing Prague as an aviation centre**

The range of vision for the pilot is quite good. This machine is only experimental, but it has already made several successful flights, when it showed very good climbing capacity, although the motor gave only 25 to 26 h.p. The climb was 1,000 m. in 10 minutes, and the speed was excellent. It is expected that with a motor of 35 to 40 h.p. the speed will be 140 km. per hour. Horizontal flight has already been accomplished with a motor of 15 h.p. It has a very gentle gliding angle, and the take-off from the ground is quick. It climbs even in sharp spirals, which is an excellent quality for a fighting aeroplane.

In conclusion, it may be mentioned that the Czechoslovakian Aviation Club was accepted this year as a member of the International Aeronuatical Federation, and by this membership is the first authority for aviation in the Czechoslovakian Republic. It directs the whole sport, grants licences to pilots, etc. It also devotes its attention to the literature of aviation, and encourages the spread of science of aviation. The Club was established in 1913, but its activity was entirely interrupted by the War. It is the centre of all engineers, pilots, both civilian and military, and all persons interested in aviation. Membership is granted on introduction of two already existing members, the entrance fee is 2 k., the yearly subscription is 60 k., or for a Founding Member 1,000 k.

The new aerodrome at Kbely, near Prague, is just now in the course of construction. The plan is conceived on a rather large scale, everything connected with aviation being provided for: water-works, petrol storage, hangars, aero-dynamic and meteorological institutions, club-houses, offices, postal and telegraph, and so on, and it is hoped that by the next year the aerodrome will be open for civilian aviation.

# THE LONDON-CONTINENTAL SERVICES

**FLIGHTS BETWEEN OCTOBER 31 AND NOVEMBER 6, INCLUSIVE**

| Route | No. of flights* | No. of passengers | No. of flights carrying Mails | No. of flights carrying Goods | No. of journeys completed† | Average flying time | Fastest time made by | Type and No. (in brackets) of Machines Flying |
|---|---|---|---|---|---|---|---|---|
| | | | | | | h. m. | | |
| Croydon-Paris ... ... | 16 | 30 | 8 | 13 | 16 | 2 43 | Airco 18 G-EAUF (2h. 8m.) | A.9 (3), A.16 (2), A.18 (2), B. (2), Bt. (1), G. (2), W. (1). |
| Paris-Croydon ... ... | 19 | 32 | 4 | 14 | 10 | 2 35 | Airco 18 G-EAUF (1h. 58m.) | A.9 (2), A.16 (2), A.18 (2), B. (2), Bt. (1), G. (2), N. (1), W. (1). |
| Cricklewood-Paris ... | 7 | 25 | — | 6 | 5 | 3 29 | Airco 9 G-EAUC (2h. 55m.) | A.9 (2), H.P. (5). |
| Paris-Cricklewood ... | 8 | 22 | — | 4 | 8 | 3 9 | H.P. G-EATJ (2h. 15m.) ... | A.4 (6), A.9 (1), H.P. (5). |
| Croydon-Amsterdam ... | 1 | 1 | — | 1 | 1 | 3 47 | — | (Airco 9 G-EAGY). |
| Amsterdam-Croydon ... | 2 | 3 | — | 1 | 1 | — | — | A.9 (1), F. (1). |
| Cricklewood-Amsterdam | — | — | — | — | — | — | — | — |
| Amsterdam-Cricklewood | 1 | — | — | — | 1 | 3 12 | — | (H.P. G-EASL). |
| Croydon-Brussels ... | — | — | — | — | — | — | — | — |
| Brussels-Croydon ... | — | — | — | — | — | — | — | — |
| Cricklewood-Brussels ... | 9 | 5 | 4 | 4 | 8 | 2 42 | Airco 9 G-EAUN (2h. 0m.)... | A.4 (2), A.9 (3), H.P. (2). |
| Brussels-Cricklewood ... | 7 | 3 | 4 | 2 | 6 | 2 35 | Airco 9 G-EAUC (2h. 15m.) | A.4 (2), A.9 (2), Br. (1), H.P. (1). |
| Totals for week ... | 70 | 121 | 20 | 45 | 56 | | | |

* Not including "private" flights. † Including certain journeys when stops were made *en route*.

A.4 = Airco 4. A.9 = Airco 9 (etc.). Av. = Avro. B. = Breguet. Br. = Bristol. Bt. = B.A.T. F. = Fokker. Fa. = Farman F.50. G. = Goliath Farman. H.P. = Handley Page. N. = Nieuport. P. = Potez. Sa. = Salmson. Se. = S.E.5. Sp. = Spad. V. = Vickers Vimy. W. = Westland.

The following is a list of firms running services between London and Paris, Brussels, etc., etc.:—Air Post of Banks; Air Transport and Travel; Co. des Grandes Expresses Aériennes; Handley Page Transport, Ltd.; Instone Air Line; Koninklijkie Luchtvaart Maatschappij; Messageries Aériennes; Syndicat National pour l'Étude des Transports Aériens; Co. Transaérienne.

# THE ROYAL AIR FORCE MEMORIAL FUND

A MEETING of the Executive Committee was held at 7, Iddesleigh House, Caxton Street, S.W.1, on Thursday, November 4, Lord Hugh Cecil in the Chair. There was a full attendance of Members of the Committee, amongst whom were:—Dame Helen Gwynne-Vaughan, Mrs. Barrington Kennett, A.V.M. Sir John Salmond, A.V.M. A. V. Vyvyan, Air-Commodore Brooke-Popham, Air-Commodore C. A. H. Longcroft, F. E. Rosher, Esq., and W. S. Field.

A list of donations and subscriptions to the Fund since the last Meeting on October 20, was presented.

A Scheme for establishing a Boys' Home for the Sons of Airmen, at Vanbrugh Castle, Blackheath, was again considered, and the recommendations of the Sub-Committee, of which A.V.M. Sir John Salmond is Chairman, were agreed to, and it was decided to make every effort to be in a position to open the Home shortly after Easter, 1921.

The R.A.F. Memorial, which is one of the chief objects of the Fund, again came up for discussion, and a letter from the Dean of Westminster, regarding the possible site near St. Margaret's Church and Westminster Abbey, was read by the Chairman; the Dean was unable to make any specific promises in the matter until he had consulted the Chapter, and the matter was left over for future discussion.

It has been decided to open a Campaign for raising funds in the provinces, and this will probably be inaugurated early in the New Year by visits being paid to Manchester, Liverpool, and certain large towns in Yorkshire. It is hoped that Lord Hugh Cecil and other prominent Members on the list of Vice-Presidents, or Members of the Executive Committee, especially those connected with the North, will speak at these meetings.

With regard to the Co-operation of the Fund with existing Organisations, matters are being very satisfactorily adjusted in such a manner that there will be no overlapping as between this Fund and existing Associations and Societies.

It was decided to ask Lady Trenchard, wife of the Chief of Air Staff, to become a Member of the Executive Committee.

The next Meeting of the Committee is fixed for Thursday, 25th inst., at 3 p.m. at the Offices of the Fund.

| | £ | s. | d. |
|---|---|---|---|
| Amount of donations and subscriptions announced up to October 19, 1920 .. | 101,125 | 4 | 9 |
| Amount since received up to November 3 .. | 882 | 4 | 7 |
| Total .. .. .. .. | 102,007 | 9 | 4 |

FLIGHT
AIRCRAFT ENGINEER AIRSHIPS

# NOTICES TO AIRMEN

## (No. 116) Aerodrome List Amendments

IT is hereby notified :—Additions and Amendments to Notice to Airmen, No. 106 (Consolidated List of Aerodromes of October 1, 1920, are as follows :—

LIST B (*b*).—*Stations temporarily retained for Service purposes*

The following should be deleted :—

| Aerodrome. | | | | Nearest Railway Station. | Nearest Town, | | |
|---|---|---|---|---|---|---|---|
| Name. | Lat. | Long. | Height above sea-level. | | Name. | Distance from Aerodrome in miles (by road). | True Bearing from Aerodrome. |
| | | | ft. | | | | |
| Chingford .. .. | 51° 38′ 0″ N. | 0° 1′ 20″ W. | 50 | Ponder's End (G.E.R.), ½ mile | London (Charing Cross) | 11 | S.S.W. |
| | | | | | Chingford | 1 | E. |

LIST C (*b*).—*Civil Aerodromes licensed as "Suitable for Avro 504 K and similar types of aircraft only."*

The following should be added :—

| Aerodromes. | | | | Nearest Railway Station. | Nearest Town. | | |
|---|---|---|---|---|---|---|---|
| Name. | Lat. | Long. | Height above sea-level. | | Name. | Distance from Aerodrome in miles (by road). | True Bearing from Aerodrome. |
| | | | ft. | | | | |
| Exeter, Marsh Barton | 50° 42′ 30″ N. | 3° 32′ 0″ W. | 20 | Exeter (L. & S.W.R. and G.W.R.) 1½ miles | Exeter | 1 | N. |

The following should be deleted :—

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Brean Down, Weston-super-Mare | 51° 19′ 0″ N. | 3° 0′ 0″ W. | 10 | Bleadon (G.W.R.) 2 miles | Weston-super-Mare | 3 | N.N.E. |
| Great Yarmouth .. | 52° 35′ 0″ N. | 1° 44′ 0″ E. | 20 | Gt. Yarmouth (G.E.R.) 2 miles | Great Yarmouth | 1 | N. |
| Locks Common, Porthcawl | 51° 29′ 0″ N. | 3° 43′ 0″ W. | 70 | Porthcawl (G.W.R.) 1 mile | Bridgend | 7 | N.E. by E. |
| Scarborough .. .. | 54° 15′ 30″ N. | 0° 24′ 0″ W. | 400 | Scarborough (N.E.R.) 1¼ miles | Scarborough | 1 | N. |

## (No. 118) Standard Methods of Indicating Bad Ground at Aerodromes in Great Britain

[*Reference : Air Ministry Weekly Order No. 931, of October 28, 1920.*]

IT has been decided to standardise the methods of indicating bad ground on all aerodromes and landing grounds owned or controlled by the Air Ministry. The figures Nos. 1 to 4 appended show the signs that will be used. They will be constructed of chalk or white stones, let in flush with the ground where practicable. In cases where the bad ground is of a temporary nature these signs will be formed of white strips :—

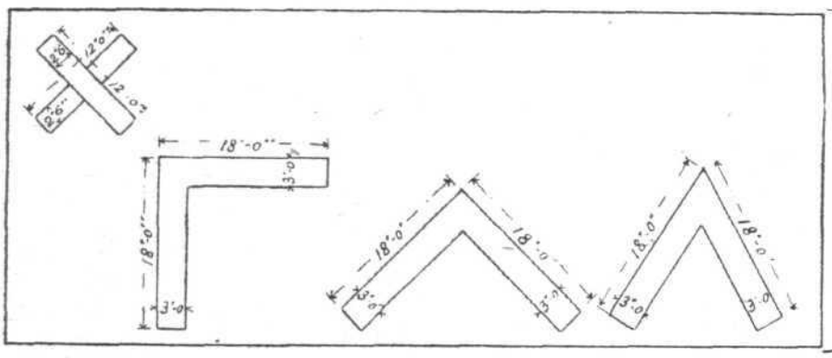
## (No. 117) Switzerland : Customs Aerodromes and Seaplane Stations, etc.

(1) THE Swiss Government have formulated the following rules for aircraft flying in Switzerland :—

(*a*) Aircraft are not allowed to fly at a lower height than 1,000 metres (3,281 ft.) above the undermentioned towns :—Basle, Berne, Bienne, Geneva, Lausanne, Lucerne, St. Gall, Winterthur, Zürich.

(*b*) Over other populated centres aircraft are not permitted to fly at a lower height than 500 metres (1,640 ft.).

(2) For the present, civil aircraft arriving in or departing from Switzerland are only permitted to use those aerodromes




**Methods of Indicating Bad Ground. Fig. 1. Details of Corner Brackets**

**Fig. 2. Fenced ground (showing fenced aerodrome with one side having bad ground). Fig. 3. Unfenced ground (showing unfenced aerodrome surrounded by bad ground). Fig. 4. To indicate a bad patch in the centre of an aerodrome**

**Note.—The angles are set up so that the sides if produced would meet, excluding or including the bad ground.**

and seaplane stations at which the Customs authorities have a control station in operation.

The following is a revised list of such stations :—

*(a) Customs Aerodromes*

DUBENDORF. Joint civil and military aerodrome.

*Position.*—Situated approximately 1 km. to the E. of Dubendorf village, and about 8 km. E.N.E. of Zürich.

*Dimensions for Landing.*—500 × 300 metres.

*Height above Sea Level.*—About 1,300 ft.

*Markings.*—Landing T in the centre of the ground.

*Night Landing Arrangements.*—No night landing facilities are available.

*Accommodation.*—About 20 hangars, 4 × 20 × 25 metres, arranged along the N.W. and S.W. sides.

*Supplies, etc.*—Petrol, oil, water and excellent repair facilities are available.

*Note.*—This aerodrome is difficult to distinguish from the air, as the sheds do not show up well, and the aerodrome itself, owing to cultivation, does not contrast with the surrounding ground.

GENEVA. (ST. GEORGES.) Civil aerodrome.

*Position.*—Situated on a plateau on the western outskirts of the town of Geneva.

*Accommodation.*—One hangar is available.

*Supplies.*—Petrol, oil and water are available.

*Note.*—This aerodrome can only be used as a Customs station by giving preliminary notice of the arrival and departure of machines to the "Société Aéro-Transport," Geneva. It has a poor landing surface, owing to the existence of ridges and soft patches. Care should be taken to avoid the electric power lines in the vicinity.

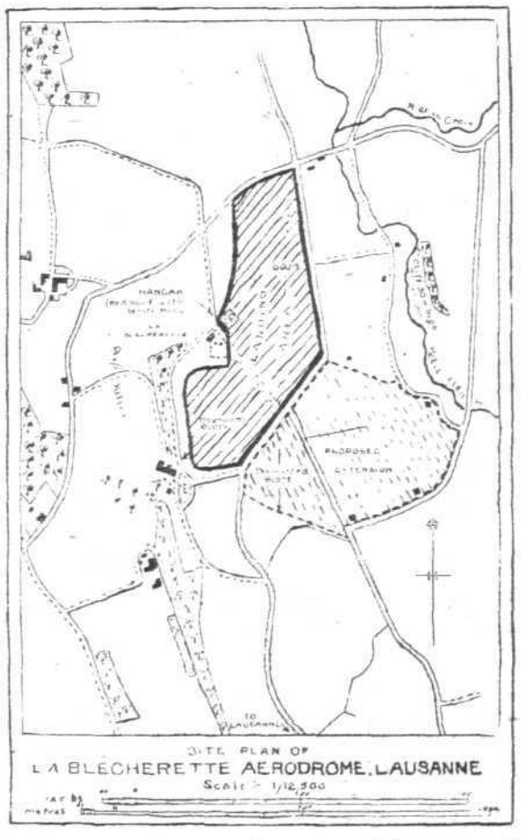
The aerodrome at St. Georges will be superseded by a new aerodrome at Cointrin when the preparation of the latter has been completed.

LAUSANNE. (LA BLECHERETTE.) Civil aerodrome (*see* plan attached).

*Position.*—Lat. 46° 33′ 0″ N., Long. 6° 37′ 0″ E.: situated 3½ km. (about 2 miles) N. by W. of Lausanne.

*Dimensions for Landing.*—600 × 400 metres.

*Height above Sea Level.*—2,000 ft.




*Markings.*—There are two white circles, each of 4 metres diameter, on the red roof of the hangar.

*Night Landing Arrangements.*—No night landing facilities are available.

*Wind Indicator.*—Flag on the corner of hangar. An arrow is also being fitted.

*Accommodation.*—One hangar 4·5 × 25 × 50 metres in the centre of W. side of aerodrome.

*Supplies, etc.*—Petrol, oil, water, and facilities for repairs are available.

PORRENTRUY. Civil aerodrome about 40 km. W.S.W. of Basle.

This aerodrome can only be used as a Customs station by giving preliminary notice of intended arrival or departure of machines to the "Consortium Seidler," Porrentruy.

*(b) Customs Seaplane Stations*

ERMATINGEN. Civil seaplane station, on the Untersee, west of Constance.

GENEVA. (EAUX-VIVES.) Civil seaplane station.

*Position.*—Lat. 46° 12′ 30″ N., Long. 6° 10′ 0″ E.: situated opposite the entrance to the park, La Grange, on the eastern outskirts of Geneva, on the edge of the lake.

*Slipway.*—There is one slipway, 8 metres wide.

*Prohibited Area.*—No aircraft is to alight at Geneva, S. of a line joining the Port Noir (Route de Thonon) on the eastern side, and the Botanical Museum (Route de Lausanne) on the western side of Lake Geneva.

*Note.*—The Customs Office, Genève-Lac (Rue de la Scie 7) or the Customs Post, Genève-Lac (Rue de Lac 5), should be advised beforehand of the arrival or departure of machines from or to abroad.

KREUZLINGEN. Civil seaplane station on Lake Constance, south of the town of Constance.

LAUSANNE. (OUCHY.) Civil seaplane station.

*Position.*—Lat. 46° 30′ 30″ N., Long. 6° 37′ 30″ E.: situated 2 km. S. by W. of Lausanne, on the northern shore of Lake Geneva, to the immediate S. of Ouchy railway station.

LOCARNO. Civil seaplane station, at the north end of Lake Maggiore, belonging to the "Société Ad Astra."

This seaplane station can only be used for Customs purposes by giving preliminary notice of the intended arrival or departure of machines to the "Société Ad Astra," Locarno.

LUCERNE. Civil seaplane station on Lake Lucerne, belonging to the "Société Ad Astra."

LUGANO. Civil seaplane station on Lake Lugano.

ROMANSHORN. Civil seaplane station.

*Position.*—Lat. 47° 34′ 0″ N., Long. 9° 23′ 0″ E.: situated to the immediate N.E. of Romanshorn, on Lake Constance.

RORSCHACH. Civil seaplane station at the south end of Lake Constance.

ZÜRICH. Civil seaplane station.

*Position.*—Lat. 47° 21′ 0″ N., Long. 8° 33′ 30″ E.: situated to the S.E. of Zürich and S. of Riesbach, on the eastern shore of Lake Zürich.

(3) PROHIBITED AREAS. No prohibited areas have been proclaimed in Switzerland, with the exception of the special restriction regarding the landing of seaplanes at Geneva (Eaux Vives) (*vide* para. 2 (*b*)).

(4) Notices to Airmen Nos. 38 and 72, of the 9th April, 1920, and 22nd of June, 1920, respectively, are hereby cancelled.

**(No. 119) Lympne Aerodrome : Night Landing Arrangements**

THE following night landing arrangements are in force every evening from sunset to two hours after sunset at Lympne Aerodrome (Lat. 51° 4′ 30″ N., Long. 1° 1′ 30″ E.). Two searchlights are placed about 50 yards apart on the leeward side of the area most suitable for landing on; the beams of light are directed up-wind, illuminating the landing area and converging at a point 60 yards from a line joining the two lights.

Machines should glide in over this line, landing as near to it as possible and in the lighted area.

Pilots wishing to land at Lympne Aerodrome at a later hour than that indicated above should arrange beforehand for the C.A.T.O. to be advised direct of the intended time of arrival. Telegraphic Address : "Aeronautics Hythe.")

**No. 6 Wing R.N.A.S. Reunion**

THE second Annual reunion dinner of No. 6 Wing R.N.A.S. is being held on Wednesday, December 8 at the Connaught Rooms, Great Queen Street, W.C.2, at 7.15 p.m. All officers and ex-officers interested are asked to send their applications, accompanied by a subscription of 12*s.* 6*d.* (exclusive), before November 27 to W. Pryor, St. Catherine's College, Cambridge.

**A Thanet Reunion**

To give all old comrades of the R.N.A.S., Westgate-on-Sea Seaplane Base, and the R.A.F., Manston Aerodrome, an opportunity of reviving old friendships made during the War, a reunion dinner has been arranged. It will be held at the Holborn Restaurant, W.C., on December 1. Tickets may be obtained from Mr. T. S. Setterfield, 1, Cuthbert Road, Westgate-on-Sea.

FLIGHT

# THE COMMERCIAL AIRSHIP—ITS OPERATION AND CONSTRUCTION*

By Commander Sir TREVOR DAWSON, Bart., R.N.

IT is important that there should be in the consideration of the future of the airship a conservative rather than an exaggerated attitude of mind.

It should not be contended that airships will enter into direct competition with transport services which can be satisfactorily operated by railways and ocean liners; it is only claimed that the airship will be supplementary to, and will not in any way replace, them.

It is on the world ocean routes that the airship will have its great opportunity; particularly for direct communication between Europe and America, South Africa, India, Australia, and the East. On these long-distance routes the saving in time will be so great that no difficulty should be encountered in obtaining the relatively small proportion of the existing total traffic necessary to support a regular airship-service.

Even in the case of carriage overland, the airship will also offer a means of transport where it would be impossible to lay down a permanent way for a railway owing to the physical obstacles, or where the cost of construction would be prohibitive. The airship needs no track, expensive in construction and maintenance.

An incidental advantage is that the terminals for the airship service can be situated close to the large cities or centres from which the traffic originates, and so save the delays and inconvenience occasioned in travelling to a sea-port.

Preliminary surveys entail extremely slow and costly work. An airship suitably equipped could take advantage of favourable weather and remain for a week at a time, and thousands of miles from its base, without extraneous aid, and afford opportunity for obtaining photographs and other data necessary for preliminary surveys.

*Aeroplane versus Airship*

The question naturally arises as to the relative utility and the sphere of operation of the heavier-than-air and lighter-than-air craft.

There has been a tendency for champions of aeroplanes to decry airships, and *vice versa*. Both the airship and the aeroplane have proved their capabilities for a *tour de force* by crossing the Atlantic; but in deciding their relative value for commercial services it is necessary to consider how the characteristics of each type affect economical operation.

The fundamental characteristic of airship design is that increase of size results in greatly increased carrying capacity, radius of action, and reduced relative power for a given speed. With aeroplanes on the other hand, there is no inherent improvement in efficiency with increase in size. The largest airships at present in use have a radius of 2,000 miles, carrying an economical load; and since their useful load and endurance increase with size, possible development is limited only by the restrictions imposed by construction and operation. The radius of action of an aeroplane carrying an economical load at present is about 300 miles, and any considerable increase in this length of non-stop flight would so reduce the proportion of useful load that can be carried as to cause very high running costs. For voyages necessitating non-stop flights of about 1,000 miles, the airship will be the more economical, and even the only practicable means of aerial transport. This implies that the airship will hold the field for Trans-oceanic aerial services, and will deal with express traffic in supplement to that of ocean steamships. The aeroplane in like manner will handle the traffic in supplement to that of railways and cross-Channel steamers. Even across land the airship will be the only practicable means of aerial transport where the physical features are such as to make the provision of intermediate aerodromes impracticable, or their cost prohibitive. Viewing the position as a whole, it may be concluded that aeroplanes and airships will not conflict or compete, but will each be specially useful in its own sphere. In the case of the great world trunk routes, the airships will work between great central aerodromes, and aeroplanes and seaplanes will serve as feeders and distributors from these terminal stations on the continental routes. To take a specific instance—an airship service from England to India would call at, say, Cairo and Karachi only. Passengers and mails for Upper Egypt, and for the various centres in India would proceed from Cairo and Karachi by aeroplane.

A great advantage of the airship is the much greater degree of comfort that can be offered to the passengers on long journeys of several days' duration.

In an airship it is possible to give the passengers plenty of room to move about, and the passenger accommodation can be so arranged as to be little affected by the noise and vibration of the engines and propellers. Separate and comfortable sleeping cabins can be provided. A comparison may be made between the conditions of travelling by aeroplane and by airship, say, from England to Australia. When the Vickers-Vimy made her wonderful trip from England, she had to land at 28 stations for the purpose of taking on fuel and oil. If aeroplanes were being used for taking passengers by this route, the passengers would either have to disembark and wait whilst the machine was being replenished at each of these stops, or, otherwise, would have the inconvenience of having to change into a different machine on each occasion. The airship, would only require to make two intermediate stops on such a voyage. Taking into account the loss of time by the aeroplane at the intermediate landings, the greater flying speed of the heavier-than-air machine would probably be entirely nullified.

Interesting experience on the relative cost of transport by airship and aeroplane, even over short distances, has been obtained in Germany. Whilst the "Bodensee" airship was operated between Berlin and Friedrichshafen, it was definitely established that the cost of this service was considerably less than half the cost of those aeroplane services of similar carrying capacity which were being run at the same time between these places. The conditions were more favourable for the aeroplane; over longer distances the comparatively low cost of airship travel would be even more evident.

*Actual Experience with Passenger Airships*

The airship has not yet been used by this country for passenger or commercial purposes. The Germans, however, had recognised their value as early as 1910, and spent large sums in experimenting. Other nations pinned their faith to the aeroplane, and, so far as airships were concerned, regarded them mainly from the military point-of-view. The experience which enabled the Germans to develop the naval Zeppelin was gained by the constant use of airships for civil flying. The German Air Travel Company, formed in 1910, and financed and managed by the Hamburg-Amerika Steamship line, ran regular passenger excursions and town-to-town services during the years 1910 to 1914. During this period these airships made over 800 flights, carrying 17,000 passengers without a single mishap of any kind involving personal injury. One of the airships, the "Viktoria Luise" is known to have made 200 trips in 250 consecutive days. This company were able to make a profit, although the passenger rates were quite reasonable; but it is not known to what extent the company was subsidised by the German Government for the use of the airships for training airship crews.

The flight of the British "R.34" to New York and back within a week has demonstrated even more fully than the German passenger services the technical possibilities of the trans-oceanic passenger services by airship, as it was accomplished with an airship not specially built or fitted out for the purpose, and much smaller than the type that would be required for commercial services on such a route. Yet the Germans were convinced of the commercial possibilities of the airship as has been demonstrated by the fact that they built, after the Armistice, in spite of the unsettled state of affairs of their country, special airships for passenger carrying, for a regular passenger and mail service between Berlin, Munich, and Friedrichshafen, for Switzerland. The first of the special airships constructed for this service, named the "Bodensee," made the voyage from Berlin to Friedrichshafen carrying 30 passengers, in four hours, and was operated daily from June to October. During the suspension of the railway traffic in November, 1919, a daily load of over one ton of mails was regularly conveyed. It has recently been reported that the total receipts of the "Bodensee" whilst running were 1,330,000 marks, and running costs only 150,000 marks, which surely indicates that it was a profitable enterprise. The Zeppelin Company are now understood to be negotiating with American interests for the organisation of an airship service to be operated from a base in Spain to the United States and South America, and are now engaged on the design and preparations for building airships of 3,500,000

* Extracts of Paper read before the Air Conference, October 14, 1920.

cubic feet capacity for this purpose. These ships will have a speed of 80 m.p.h. with accommodation for carrying 100 passengers with an allowance of 100 lbs. of baggage per head, together with 6 or 7 tons of mails. The promoters have stated that they think this service could be operated at rates very little higher than the present cost of first-class passage on ocean ships.

## The Operation of Airship Services

### *The Traffic Possibilities*

The speed of the large rigid airship of today is 60 to 70 miles per hour, and with probable increased efficiency of the engines, and the adoption of larger airships for greater world routes, there will be no difficulty in attaining a speed of at least 80 miles per hour, which would enable an average speed of 60 miles per hour to be attained on long voyages without difficulty.

The fastest ocean steamships of the world cross the Atlantic at a speed of 25 knots (28 miles per hour); but even this speed is exceptional, and is confined to liners of the very largest size; 18 knots is more usual.

It is only between great centres of population that there is a large enough volume of passenger traffic to justify the great size of steamship necessary to maintain a speed of even 22 knots. On such routes as from Europe to South Africa, India, or Australia, it is commercially impossible to run ships with anything approaching this speed.

In the case of airships of even the largest sizes contemplated, the number of passengers and the weight of mails required to maintain a service is relatively small, and they could therefore be run over routes where an average speed of more than 18 knots (21 miles per hour) by steamship would be commercially impossible.

Even on the trans-Atlantic route, between Europe and the United States, there must be on any week in the year some hundreds of persons to whom the crossing of the Atlantic in two or three days, instead of six or more, would be well worth the expenditure of say 50 per cent. more than the usual steamship fare.

From investigations that have been made into the present passenger traffic, it is not considered that there would be any difficulty in obtaining the necessary support for running a weekly or bi-weekly passenger service from Europe to South Africa, India, Australia or South America. There should be no difficulty in reducing the present time taken from London to Cape Town from 18 days by steamship, to 5 days by airship; and to India from 16 days to 4 or 5.

The saving of time on these long ocean journeys would be particularly valuable for the delivery of mails. Postal services by airship will fill the gap between cable communication and the present mail services. A letter weighing an ounce could contain some thousands of words, and if the cost of cabling only a single word were charged for its carriage by air, the airship transport company would be handsomely remunerated. Interesting statistics of the weight of letter mail despatched per week from the G.P.O. to the various ports of the British Empire were given in a valuable paper by General Sir F. H. Sykes, on "Imperial Air Routes" read before the Royal Geographical Society. The figures were:—

To Egypt, 2,000 lbs.; South Africa, 4,000 lbs.; India, 8,500 lbs.; Australia and New Zealand, 9,500 lbs.

It is therefore evident that the whole of the weekly letter mails to these places could easily be carried by a weekly airship service, and still leave room for a considerable weight of express cargo.

### *Size of Airship Required*

From an examination of the great ocean routes of the world, it is found that a maximum distance of non-stop flight between stations of 3,500 miles will allow of direct communication between any of the great traffic centres of the world, so that an airship able to carry enough fuel and oil to fly this distance at the required speed, including a suitable reserve to provide for adverse weather, and carrying an economical load of passengers, mails, etc., would be suitable for service on any of the world routes.

It is considered that the most suitable economical commercial speed to be maintained throughout these voyages should be 60 m.p.h., which while high enough to enable an attractive saving of time, would be economical. To enable this average to be maintained the maximum speed at full power should be *at least* 80 m.p.h. To conform to these requirements, and to enable an economical load to be carried after allowing for the additional weight involved in fitting passenger accommodation, a rigid airship of at least four million cubic feet gas capacity will be required, which would enable suitable provision to be made for carrying about 100 passengers. This size of airship would have a length of about 800 ft., with a maximum diameter of about 100 ft. The largest airship yet built is not much over two million cubic feet, so that considerable advance has still to be made in design and construction before an airship can be produced suitable for regular and economical passenger carrying.

### *Safety and Dependability*

The objection frequently put forward that airships run a great risk of destruction by fire is a natural impression caused by the frequency with which the German Zeppelins raiding London were found to be vulnerable to incendiary bullets. One might as well condemn merchant ocean ships because they could be sunk by gun fire. Only one case is known of a rigid airship being accidently destroyed by fire, and actual experience has demonstrated that if ordinary precautions are observed, the danger is negligible, and not greater than the risk of fire on board steamships at sea.

The only other risk whilst in the air is that of breakdown of the engines. Rigid airships never have less than four engines, and the large passenger ships will have six, eight, or even more. A complete breakdown of all engines is most improbable, and the airship could still travel at four-fifths full speed if only half the total number of engines were in action.

As previously mentioned, the German airship service operated before the War carried 17,000 passengers without a single personal injury; this notwithstanding that on two occasions airships were wrecked on landing, but the passengers were got off without any difficulty.

There is no discomfort experienced in the air corresponding to the plight of passengers on a steamship which is being rolled and pitched about by heavy seas. The conditions of the airship are rather comparable to those of a submerged submarine boat which is not affected by disturbances of the surface waters.

With regard to danger of passing through electrical storms, information has been published that the "Bodensee" actually passed through an electrical discharge without other damage than the burning of the wireless aerial. There is no reason why airships should ever encounter the violent thunderstorms and cyclones which occur in various parts of the world, as these storms extend over a very small area, and there should be no difficulty whatever in the airship being able to avoid them.

To be of any advantage for the carriage of mails and passengers, reliability and regularity of departure and arrival is essential. Serious delay owing to mechanical breakdowns of the engines and machinery is not likely, but, at the same time, it is probable that a special type of airship engine will require to be evolved to withstand the extremes of heat and cold which would be experienced in some parts of the world.

### *The Influence of Weather*

Winds will of course, have a considerable effect on the time taken to complete a voyage. As is well-known, there are, at sea level, between fairly well defined latitudes, permanent winds of generally constant direction, of which advantage can be taken by suitably laying out the course to be followed and varying that according to the season. Again, at the higher levels of the atmosphere, there is, in most latitudes, a constant drift which may be helpful if the winds at other levels are unfavourable. The importance to aeronautics of charting the upper air has been recognised, and it is satisfactory to know that organised efforts are being made to carry it into effect.

It is now the opinion of meteorologists and experienced airship pilots that, instead of wind influences having the effect of lengthening the time for voyages, the passages over long sea routes will be shortened when routes are suitably arranged in accordance with the meteorological information regarding the prevailing winds and local conditions. On the average, about 15 to 30 m.p.h. may be added to the speed over the ground.

### *The Development of the Mooring Tower*

If airships required to be taken in and out of sheds between voyages, it would be impossible, with the climatic conditions prevailing in this country, to arrive and depart independently of the wind; because although a modern rigid airship may be in the air with perfect safety in practically any state of the weather, it is not advisable to enter or leave a shed with a wind blowing at a greater velocity than 20 m.p.h., and it would be quite impossible to adhere to a time-table for times of departure and arrival. There is no reason, however, why the actual departure or arrival of an airship at an aerodrome should in any way be delayed by wind, provided that the aerodrome is equipped with suitable mooring towers and landing gear.

Following on the very successful experiments carried out

with non-rigid airships moored to the type of mooring-mast introduced by Air-Commodore Masterman, an experimental mooring tower for rigid airships was developed by Vickers, Ltd., in collaboration with the Air Ministry, and used at one of the airship stations for a comprehensive series of mooring tests with "R.24" one of the early British rigid airships of the "R.23" class. During these tests the ship lay out continuously for several weeks, during which it was subjected to gusts of wind blowing up to 50 m.p.h., phenomenally heavy rainfall, snow storms, and every extreme of the British weather. The behaviour of the airships demonstrated conclusively the practicability of this system of mooring, and it was found that only 6 men at a time were needed to look after the mooring of the ship.

Designs are now being prepared for a mooring tower specially arranged for use with passenger-carrying airships. The revolving head of the mast will be provided with a powerful hauling winch for hauling-in the mooring head of the ship to the automatic coupling apparatus and shock absorbing buffer which will enable the airship to be coupled up without difficulty even in winds up to 70 to 80 m.p.h. A passenger lift is provided within the mast-structure.

Pipe mains for the supply of hydrogen, petrol and water to the airship also run up to the head of the tower, and so enable gas, fuel, and ballast to be supplied to the vessel in preparation for her next voyage with the least possible delay.

*Airship Bases*

It should not be forgotten that the present-day safety and regularity of steamship services is largely due to the development of safe ports and harbours, and to the lighting and charting of the coasts. This required many years and the expenditure of millions of pounds.

Before regular world-wide air communications are practicable, it will be essential to provide an equivalent equipment of landing stations, night signalling and a reliable and elaborately-organised meteorological intelligence service.

Eight main bases, with the same number of intermediate calling stations, would serve for airship services linking up Europe to North and South America, Egypt, South Africa, India, and Australia, and from these main bases smaller airships or aeroplanes would enable communication by air between all the chief centres of population in the world.

Each of the main bases would be provided with a number of sheds and mooring towers according to the number of airships in service, and the intermediate stations with mooring towers only. Both main and intermediate bases would be provided with hydrogen generating plant and storage for petrol and oil. The wireless equipment would be such as to enable an airship *en voyage* to be in constant communication with the nearest base.

*The Need for Trained Pilots*

Whilst we now have in this country airships which would be suitable for the running of experimental mail-carrying services, and the designing and constructional facilities which would enable us to build the larger type of airship required for regular passenger-carrying services, we still lack experience in the flying and handling of airships under the conditions appertaining to commercial services.

The necessary experience and training can only be obtained by regular and constant flying, and it is strongly recommended that the airships that are at present available should be kept in constant service by the Air Ministry for this object. It would be desirable to put up several mooring masts of the simplest type necessary for training purposes in order that the pilots may become familiar with their use before having to undertake the command of an airship that will require to be used on the regular commercial services. The Germans have a great advantage in this respect, as many of the Zeppelin pilots who were employed on the passenger airships before the war have now made some thousands of flights.

It takes at least two years' regular flying to train an airship pilot; not so much in the actual flying of the airship, but in the landing and handling.

*Will the Cost be Reasonable?*

Fairly reliable estimates of the running costs of airships can be made; but allowances for depreciation and maintenance in particular are at present a matter of surmise as these can only be ascertained by trial on a commercial scale over a period of years.

On the authority of Air-Commodore Maitland, the Director of the Airship Service, who has all the service records at his disposal, the probable costs for a regular service of airships between England and India to carry 4 tons of cargo and 100 passengers each way per week would be about 2*s.* 9*d.* per ton-mile, giving passenger rates about 50 per cent. higher than the present first class steamship rates, and mails at 6*d.* per ounce.

An approximate estimate has been prepared of the possible limits of the cost of carriage by airship, taking on the one hand the most favourable conditions that might be expected with a fully established service working on a favourable route with the best possible weather conditions, and such a demand that the service would be operated at full capacity all the year round; and on the other hand taking the most unfavourable conditions as regards cost and running conditions. The service investigated was on a basis of a regular two trips each way per week between places requiring a non-stop flight of 3,000 miles, which would be operated by airships of the 4,000,000 cubic feet capacity type previously described.

Taking the speed as averaging 60 miles per hour for the voyage, the time taken would be 50 hours, so that each ship could easily make two voyages per week. Thus two ships in service would make the required two trips each way per week. A third ship is held in reserve to enable each ship to be laid up periodically in turn for complete overhaul. If the two trips each way were kept up 52 weeks in the year, each of the three ships would have to do an average of between 3,400 and 3,500 hours flying and on this the cost of maintenance is based.

Allowing an ample allowance for the weight of petrol and oil and other non-useful loads, this size of airship would be able to carry a full load of 24 tons of passengers, mails or light freight. Accommodation is provided for 100 passengers who would be allowed a total weight of 300 lbs. per head, thus leaving further carrying capacity for about 10 tons of mails and special freight.

At each terminal aerodrome it would be necessary to have two housing sheds, a mooring mast equipment, hydrogen supply plant, workshops, and facilities for repairs, wireless and meteorological station, not forgetting a good allowance of spare parts.

Without entering into details of the estimates—which are based on present-day prices—the following figures which indicate the conclusions arrived at may be given:—

| *Capital Required* | £ |
|---|---|
| For 3 airships and flying equipment .. .. | 1,500,000 |
| For sheds, mooring masts, and other equipment for two aerodromes .. .. | 1,300,000 |
| Giving a total of .. .. .. | 2,800,000 |
| Or say, with working capital, a round figure of | 3,000,000 |
| Allowing for paying interest at 15 per cent. on this capital, this would mean an annual charge of .. .. .. .. .. | 450,000 |

*Depreciation and Obsolescence*

In the absence of actual experience of the deterioration of airships when constantly operated week-in and week-out in all kinds of weather, all the year round, it is difficult to decide what working life should be allowed to determine the rate at which their value should be written off. This is an item that is frequently discreetly relegated to the background. The probable life is variously estimated at from three to five years, so that the charge on this account would be from £300,000 to £500,000 per annum, and for sheds and ground equipment, say, £100,000 per annum, a total of from £400,000 to £600,000.

*Repairs and Maintenance*

Owing to the wear and tear of constant service, it is probable that the outer covers would require replacement about every six months, and the gasbags every two years, whilst the engines should have a life of at least two years. There will also of course be the cost of maintenance of the sheds and other aerodrome equipment. These items are estimated at from £100,000 to £300,000 per annum.

| *Establishment Expenses* | £ |
|---|---|
| Pay of officers and crews .. .. .. | 35,000 |
| Salaries and wages of establishment and aerodrome staffs .. .. .. .. | 150,000 |
| Total .. .. .. .. .. | 185,000 |

or say between £150,000 to £200,000.

*Insurance*

In the absence of any accumulated statistics of risk, it is impossible to say what rates would require to be paid for insurance of the airships against total loss or serious damage, and whilst it is thought the risks of total loss of an airship will eventually be very small, in the early stages of operation, there is always the possibility of a mishap. Therefore in the early stages the rate will be high, and may amount to 33 per cent. per annum on the total airship value. The insurance for three ships would thus be as a maximum say

£500,000, and might be at as low a rate as to involve a total sum of only £200,000.

*Running Costs*

The running costs, including petrol, oil, and hydrogen, can be estimated with some degree of confidence, and for airships of this size, will total from £40 to £60 per hour's flying, and as we have assumed a total of 10,400 hours per year for the three airships, running costs will amount to between £400,000 and £600,000.

| *Total Annual Costs* | £ |
|---|---|
| 1. 15 per cent. on capital .. .. | 400,000 to 500,000 |
| 2. Depreciation and obsolescence .. | 400,000 to 600,000 |
| 3. Repairs and maintenance .. | 100,000 to 300,000 |
| 4. Establishment expenses .. .. | 150,000 to 200,000 |
| 5. Insurance .. .. .. .. | 200,000 to 500,000 |
| 6. Running costs .. .. .. | 400,000 to 600,000 |
| | 1,650,000 to 2,700,000 |

*Earnings*

Assuming a full load is carried every voyage, the total paying load per year is 5,000 tons, carried a distance of 3,000 miles, and to cover the total expense enumerated in the table the rate would require to be from 2*s*. 3*d*. to 3*s*. 8*d*. per ton-mile. It is highly improbable, however, that even under any circumstances a full load would be carried on every voyage, on a regular service maintained the year round, and it would be reasonable to take a load factor of only 50 per cent., which of course would double the above rates, which would then be from 4*s*. 6*d*. to 7*s*. 4*d*. per ton-mile. If carrying passengers and allowing for the cost of their food, attendance, etc., this would correspond to from 10*d*. to 1*s*. 4*d*. per mile, or rather more than twice the present rates for first-class passage by ocean liner. The rate for carrying mails would be from 5*d*. to 8*d*. an oz. for the 3,000 miles.

It is most important to observe that even when carrying maximum load the running costs or the cost of actually flying the airships only forms about 20 per cent. to 25 per cent. of the total cost of the service, the remainder being overhead cost which continues irrespective of the amount of traffic that is handled, and would not be greatly reduced even if the ships were laid up. This is the crux of the matter and shows quite clearly that the possibility of operating airships at an economic cost depends entirely on being able to ensure a regular and uniform traffic, and any estimates of cost can at present only be surmised, and may be anything from 4*s*. 6*d*. per ton-mile upward, and probably a conservative estimate would be nearer 10*s*. per ton-mile.

*Desirability of Experiment on a Commercial Scale*

As often happens in pioneer work, a service expected to show good profits when fully established may have to face considerable losses during the initial stages.

Some of the existing service airships are quite suitable for adaptation to carry out experimental services over comparatively short distances, and a very suitable route for this purpose would be that from Egypt to India *via* Basra and Karachi, where the maximum distance between bases need not be more than 1,250 miles.

Experience gained on such an experimental service as this, particularly in the carrying of mails, would enable actual figures for the cost of operating and maintenance to be obtained, and also secure valuable data regarding the effect of extreme temperature conditions on the fabric used for the airship outer covers and gasbags.

In view of the great imperial importance of airship services and of the value of continuing to stimulate scientific design work and the training of pilots in operating airships for naval purposes, it is thought that such a trial of airship transport on an experimental scale, should be made with the co-operation of the Imperial and Dominion Governments, either as a purely state enterprise, or in association with the great shipping companies and transport interests.

*State Ownership or Private Enterprise?*

In considering the organisation necessary for the operation of the airship services the question arises whether this should be undertaken by the State, or by private enterprise. Under a responsible and qualified administration the support of the State would be a great asset, particularly as the most suitable traffic for airship services in the initial stages would be the carrying of mails and Government traffic. State assistance and control would, also, be most valuable in the provision and maintenance of the great terminal bases from which the airships services would operate, even if and when the operation of the actual service is taken over by private control. In the case of steamship traffic, docks and harbour facilities are rarely the property of a shipping company, and steamship owners use these docks on payment of standing charges, but individually they have no monopoly of the service. Similarly it would appear desirable for the aerodromes with their sheds and mooring towers, etc., to be owned by the State. But for the actual operation of the airship services private enterprise would be the best arrangement, with competition always inciting to technical improvement and economy of operation. Such a company could undertake the carrying of mails on a yearly contract with a guaranteed minimum load.

**Airship Construction and Development**

The power-driven airship only became a mechanical possibility with the advent of the light internal combustion engine, developed by automobile engineers in the latter part of the nineteenth century, and the rigid airship only became a practical problem with the invention of light and strong aluminium alloys at the beginning of the twentieth century.

The development of the rigid airship by the Zeppelin Company has been steadily prosecuted since the year 1900. Rigid airship construction in this country was only really commenced in the year 1914, and has suffered many vicissitudes owing to changes in policy.

Airship design in this country, therefore, was primarily based on German practice, and it is only in the most recent designs of "R.80" by Vickers, Ltd., and the "R.38" now being built by the Air Ministry, that purely British ideas have been put into into practice. The largest rigid airship in existence is the Zeppelin "L.71," which was recently handed over to the Air Force, and it may be of interest to compare the particulars of this ship with the 4 million cubic ft. ship which will be required for the world airship routes:—

| | Gas capacity (cubic ft.). | Total lift (tons). | Length (ft.). | Diameter (ft.). | Full speed (m.p.h.). |
|---|---|---|---|---|---|
| "L.71" .. | 2,430,000 | 74 | 750 | 78 | 75 |
| Proposed ship | 4,000,000 | 120 | 800 | 100 | 80 |

Apart from the increase in size that is necessary to enable an economical load to be carried for a distance of 3,500 miles, and to allow of increasing the speed up of 80 m.p.h., there are other problems requiring thorough investigation, amongst which the following desiderata are the most important which affect design: (1) An airship must be able to depart and arrive at the bases in all kinds of weather with safety and regularity. (2) A really reliable and economical engine specially suited for airships has still to be produced. (3) Methods of treating the outer cover fabric are required that will ensure tautness and watertightness in all kinds of weather, and extremes of temperature for reasonable lengths of time without rapid deterioration and necessity of frequent replacement. (4) Experience is necessary as to the effect of tropical climatic conditions on the covers and gasbags and on the maintenance of the airships generally.

The problem of being able to take the air and return to earth with safety in any kind of weather, and with the assistance of a reasonable number of men has already been solved in principle by the mooring tower.

With the exception of the Wolseley-built Maybach motor, no essentially-airship engine has yet been produced in this country. An engine of a simpler and more robust type is wanted which can run continuously for periods of at least 50 hours without any risk of breakdown. The ideal type of internal combustion engine for airships would be of the Diesel 2-cycle type which would have most valuable advantages. An engine of this type could be run on almost any kind of liquid fuel. This would reduce a considerable item in the running costs and facilitating supplies at out-of-the-way stations. The heavy fuels used would also eliminate the danger of petrol fire. On the long duration flights which will be the practice with airships, the weight of fuel and oil is many times greater than the dead weight of the engines, and for this reason the lower fuel consumption would more than compensate for a considerably heavier weight of the Diesel engine.

There has not yet been any serious attempt to produce a Diesel engine suitable for aero purposes, and the lightest type of Diesel engine yet made weighs about 30 lbs. per b.h.p.; but no attempt has been made to use the special material or methods of reducing weight used in the aero engine, and although with its higher compression pressure it will essentially be heavier than the petrol engine, there does not appear to be any reason why a suitable Diesel engine should not be produced of say 10 lbs. per b.h.p.

*Possibilities of Reducing the Cost of Construction and Operation.*

The rigid airship only became possible by the use of the special alloy "Duralumin," which has a specific gravity of only 0.28, has a tensile strength of 28 tons, per square inch, or practically the same strength as mild steel for only one-third its weight. With this material the constructional

design of rigid airships has been developed by mathematical analysis and experiment to a degree of efficiency far beyond that attained in any other branch of structural engineering, but finality has by no means been reached, and useful reductions in structural weight are possible by continuing systematic study of structural detail design.

The chief items in the actual running cost of an airship in which it is possible to effect considerable savings, are the cost of fuel and of hydrogen. If, as has been previously mentioned, an engine of the Diesel or some other type that could use cheap fuels was developed, the cost of fuel used would be greatly reduced. In the case of an airship making frequent long voyages, consumption of gas is mainly due to the losses whilst in flight necessary to reduce lift corresponding with the loss of fuel consumed by the engines. The losses of gas escaping by diffusion and leakage are relatively insignificant.

Although gasbags lined with goldbeaters' skins have extremely low permeability, the cost of the skins and the amount of labour required to apply them to the fabric is very great, making the bags very costly. It is therefore considered that for ordinary commercial use it would be unnecessary to have skin-lined gasbags provided hydrogen could be produced at a sufficiently low figure.

The cheapest method of obtaining hydrogen would be to utilise gas which is the by-product of the alkali or other industries, and where other requirements will allow of this, great economy would be obtained in hydrogen costs by locating a terminal or intermediate base near such an industry. This, however, would only be possible in very exceptional cases, and it would generally be necessary to have gas-generating plants. The cost of gas forms a considerable item in the cost of operation of services, and a process of producing hydrogen very cheaply in large quantities at the great terminal stations from which airships would be arriving and departing daily would effect a great saving in running costs.

Mention may also be made of two other directions in which very valuable research might be carried out with the object of effecting savings iu the consumption of gas on airships. By using hydrogen that would otherwise be discharged as fuel in an engine specially fitted for the purpose, the value of the saving in cost of petrol would practically cover the cost of the hydrogen used. Apparatus can also be developed for condensing the water of combustion in the exhaust gases of the engines, and it has already been demonstrated that it is practicable to recover a weight of water almost as great as the weight of fuel consumed, thus greatly reducing the amount of hydrogen required to be discharged.

*Conclusion*

It is very difficult to foresee what developments in aircraft the next ten or even the next five years may bring; but imperial interests demand that every endeavour should be stimulated to maintain scientific and practical developments in this country. It would be dangerous to wait and see what other nations will do.

It is significant that the United States have devoted $25,000,000 for airship construction, and, with an eye to future developments, is building an airship shed which will hold airships of 10,000,000 cubic feet capacity.

France, after hurriedly disposing of her airship material at a heavy loss in the interests of economy, has entirely changed her attitude, and has voted an equivalent of £3,000,000 to re-equip her airship service.

Italy is a firm believer in the airship, and is making steady progress, and at her present rate has the lead in construction of airships of the semi-rigid type.

Germany, with her unparalleled experience in airship construction, is in a position to go ahead as soon as the restrictions of the Peace Treaty allow, and but for these there is no doubt that she would already have in actual operation air liners crossing the Atlantic. A recent report from Berlin states that the Zeppelin Company is contemplating building these airship liners in the United States, and so evading the prohibitions of the Allies, the scheme being to build two super-Zeppelins for use in freight and passenger service between Berlin and San Francisco, calling at Paris, New York and Chicago—the schedule time for the entire trip from Berlin to San Francisco to be less than four days. From information obtained from America it is understood that these airships are to be capable of carrying loads of 30 tons. The scheme is said to be backed by the Hamburg-Amerika Line and prominent American financiers. This being the case, a widespread empire like our own should surely do all it can to build up a powerful fleet of commercial airships. We, as the leading mercantlle nation, with interests all the world over, should lead in the new era of aerial transport as we have led on the sea in the past.

# AVIATION IN PARLIAMENT

**The Transport Ministry and Aviation**

CAPT. TERRELL, in the House of Commons on November 1, asked the Minister of Transport whether there is any branch of his Department to which is attributed the duty of looking after aerial transport; how much in that case it costs annually; and what it has actually done hitherto?

Sir E. Geddes: The answer is in the negative.

**Prisoners of War, Field Allowances**

SIR FRANCIS LOWE, on November 2, asked the Secretary of State for Air whether officers of the Royal Flying Corps were paid 5s. a day field allowance whilst they were prisoners of war, but officers of the Royal Naval Air Service were not paid this allowance under the same conditions; and whether any steps are now being taken to remedy this inequality of treatment?

Mr. Churchill: Issues of field allowance, lodging allowance, and fuel and light-allowance were made to officers of the Royal Flying Corps who were prisoners of war at varying rates, according to their rank in the service. These amounted, in the case of lieutenants and second-lieutenants to about 5s. a day. As from April 1, 1918, when the Royal Flying Corps and Royal Naval Air Service were amalgamated, the same allowances as had been previously issued to the Royal Flying Corps were authorised for all officers of the Royal Air Force who were prisoners of war. Any question relating to the allowances payable to officers of the Royal Naval Air Service before April 1, 1918, should be addressed to the Admiralty.

**The Air Conference**

SIR W. JOYNSON-HICKS asked the Secretary of State for Air what steps he proposed to take in regard to the resolutions passed by the Air Conference?

Mr. Churchill: The proceedings of the Air Conference are to be published as a Command Paper.

Sir W. Joynson-Hicks: Can we have an assurance that the right hon. gentleman will bring the very important resolution relating to Egypt before the Cabinet at the earliest possible moment so that it may be fully considered before the conclusion of the negotiations?

Mr. Churchill: I have already done so.

**The Air Navigation Bill**

ON November 4, Standing Committee A, presided over by Sir William Pearce, considered the Air Navigation Bill, which has already passed the House of Lords and which would enable effect to be given to the Convention signed in Paris on October 13, 1919, for regulating air navigation and make further provision for the control of aviation.

On Clause 9, which provides that "no action shall lie in respect of trespass or in respect of nuisance by reason only of the flight of aircraft over any property or the ordinary incidents of such flight," Mr. J. F. P. Rawlinson moved an amendment to leave out the words after "trespass," in order to insert "by reason only of the flight of aircraft making a mere passage over any property." The clause as it stood would, he said, take from a man the right to take action for nuisance. It would leave people unprotected against the improper use of aircraft.

Mr. Churchill expressed the hope that the Committee would accept the Bill as it stood. It strengthened the power of people in regard to damage, and reduced their power in regard to nuisance. If the law remained as it was today, aerodromes could be closed all over the country at any time, owing to injunctions, and that would have a most disastrous effect on aerial navigation. No doubt a certain amount of inconvenience arose in the neighbourhood of aerodromes from the movement of aeroplanes, but the same might be said of railway trains and motor-cars. He hoped the annoyance would be reduced as machines better adapted to the purpose were introduced, and he looked forward to a silent, or comparatively silent machine in the near future.

The amendment was rejected by 18 votes to 8, and Clause 9 was agreed to.

Mr. Churchill asked to be excused from further attendance, as his presence was necessary at a Cabinet meeting to consider War Office business.

On the clause dealing with the establishment of aerodromes Mr. Rawlinson moved the omission of the words empowering any local authority to establish and maintain aerodromes. He said that at seaside towns the power might be used to attract visitors, and would become an intolerable nuisance in a popular sense. It would be much better to give such powers to private concerns. No limit was imposed by the clause to the borrowing powers of local authorities. They ought to stop local authorities from speculating with ratepayers' money to an unlimited extent in that way.

Mr. J. E. Davison, supporting the clause, said the Labour Party hoped to see local authorities taking workmen to their work by aeroplane.

Lieutenant-Colonel Moore-Brabazon (for the Secretary of State for Air) said the Air Council did not propose that any local authority should run a service, but that they should be able to deal with matters which were ancillary to the carrying on of an aerodrome. They had already had applications from several big towns with regard to transport between those places and other centres. An air service was like a railway, and the nearer they could get an aerodrome to the centre of a town, so much the better.

The amendment was rejected by 13 to 6, and the Bill was ordered to be reported to the House.

**Double Fatality at Kenley**

WHILE attempting to land at Kenley about 5 p.m. on November 4 a machine crashed, and the occupants, Flying Officer N. E. Fenwick, M.C., and Flying Officer H. O. Prout, were killed. At the inquest Flying Officer Trevor Salt stated the officers left Kenley aerodrome in the morning for Winchester. When they left Winchester in the afternoon the weather was fine, but later a heavy fog developed, and witness telephoned to Winchester to stop the officers going back, but he was too late. Answering the Coroner, witness said the Kenley aerodrome was difficult to land in, the trees rendering it particularly dangerous during foggy weather.

The Coroner, in recording a verdict of "Accidental Death," mentioned the fact that he had previously held inquests on officers who had been killed while trying to make descents in this locality.

# AIRISMS FROM THE FOUR WINDS

THE Missing Link is again to the fore, this time from America. Probably as a result of the putting up of a £50,000 fund, chiefly by the American Asiatic Association and some wealthy New York residents, this new interest has been created. The only interest to readers of FLIGHT which this item of news may carry is attached to the fact that amongst the impedimenta which the would-be unravellers of the secrets of nature will carry with them upon their expedition will be some aeroplanes. Quite how these are to assist in the business does not transpire. Maybe it is hoped that when these fearsome "birds" are seen by Mr. Link "hovering" up above, he will at once wave a flag, and by calling for "Ellup" give away his hiding-place. Anyway, this new expedition hopes to unearth primitive human remains that will establish the link between man and the ape, and will shortly for that purpose leave the United States for Central Asia, where scientists believe man as distinct from the monkey species originated.

In addition to aeroplanes, motor-cars, camels, mules, and all means of locomotion found suitable, will be used by the anthropologists, archæologists, and other scientists, who will start on the quest under the leadership of Mr. Roy Chapman Andrews, of the American Museum of Natural History. It is proposed to explore hitherto unpenetrated parts of Thibet, Turkestan, and the Mongolian Desert, among other regions.

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BUT £50,000 does not sound these days as an over-generous total to do all "them things." We fancy there'll be another missing link before they've finished.

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A SIGNIFICANT note comes from Germany. The extra charge for carrying letters by the aerial mail service in operation between Berlin and the Rhine is only one-fifth of a penny!

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TRUST the Bolshie to go—on paper—one better than anybody else. His latest to impress is the twenty-four thousand horsepower airship to carry 1,000 passengers. This little toy is to have a freight-carrying capacity of 1,000 tons, will have several berth decks, a lift providing communication between them, will carry a motor-car, a motor-boat and an aeroplane, and will have a speed of sixty-six miles per hour. All this is according to the promise of its designer, M. Makhonin and May 1 next year is given as the date of the airship's completion. As the whole scheme has been examined and approved by a special Committee—presumably also Bolshies—of experts of the expert kind, and the above details disseminated *via* the Russian Wireless, why it *must* be true.

Anyway, it sounds like some airship, and we hope it *may* be ready at the date fixed by its designer. The month, however, is significant.

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LONDON-PARIS looks like being a pattern air-route presently. According to the latest information published, including the aerial lighthouses at Croydon, Lympne and Calais, there are to be in all 15 of these "guides" for nightflying between the two capitals; six in S.E. England and nine between the sea and Paris. Each lighthouse is to flash a distinctive Morse signal for the guidance of the pilots.

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PHOTOGRAPHS from the air of properties for sale are now quite an ordinary phase of business activity in connection with large estates. But apparently, in another although similar direction, an enterprising estate agent in Salem, Oregon, has got well ahead of us this side the herring-pond. Mr. Charles W. Niemeyer, writing upon the subject, states that whilst he has never published photographs of country properties for sale, he has for more than two years actually been selling farms after they have been viewed by his customers from a twin-seater De Havilland. But then, Oregon-way distances and farms are no doubt somewhat more extensive and extended than in the case of "compact little estates" in our bit of an island.

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AVIATION has already had to put up with a goodly measure of poetry, good, bad and indifferent. And now according to the Rome correspondent of the *Observer* the world has gotten its first aviation Opera. This is described as a work of futurist character and has been staged at Lugo. It is called "Airman Drò" and is by Signor Pratella, a futurist composer and great friend of Marinetti. The music, however, is not unduly eccentric, and the critics are agreed in allowing it considerable worth. The critic of the "Corriere della Sera" speaks of it as "a noble work." Touches of futurist theory introduce sometimes, however, the ridiculous element. The noise of the aeroplane's engines (represented by a motor-bicycle in the wings) is made to form a kind of additional new instrument for the orchestra in the last act, and in the *fortissimo* passages is allowed to "race" wildly.

Airman Drò is a man who wishes to free himself from the tyranny of the senses and to purify a life of ease and luxury by some heroic action. He stakes his entire fortune with a friend, loses, and sets out to face a life of struggle. In aviation he finds the kind of action and danger his spirit had been seeking. In the end he meets death in the skies, and consummates his wish for an heroic last act.

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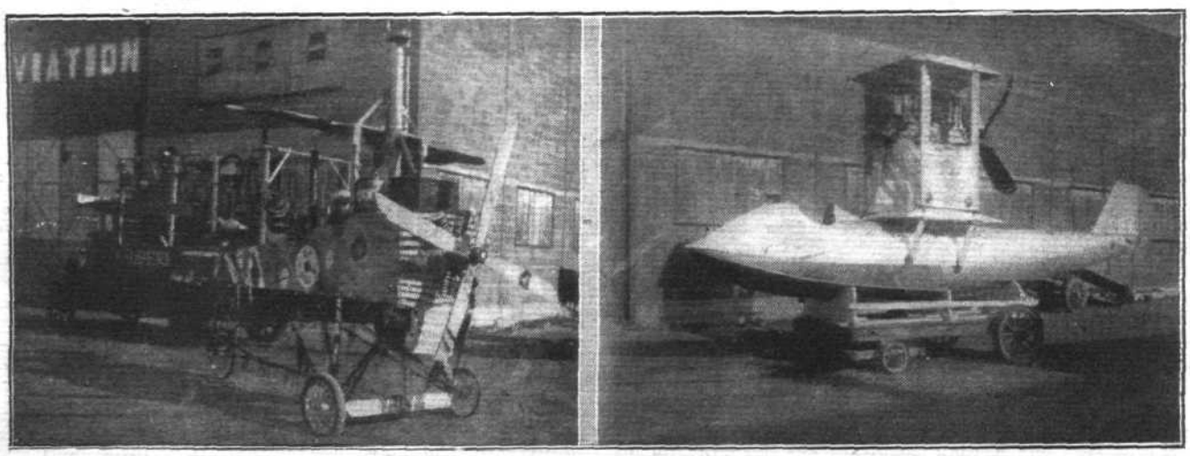
MOUNT EVEREST *is* doomed. On Monday it was confirmed by Lieut.-Col. Sir Francis Younghusband, President of the Royal Geographical Society at a meeting of that body, when Brigadier-General the Hon. Charles Bruce read his paper upon the subject, that the conquest of this hitherto unclimbed peak is to be attempted with the help of the India Government and aeroplanes. But we've still got to bide a wee, as the Viceroy is of opinion that the present time is hardly a propitious moment in which to launch the attempt. Wonder if the "Missing Link" is skulking on the top? And like Livingstone will refuse to be "rescued."




**THE LIGHTER SIDE: A good performance was put up by the Supermarine team in the Royal South Hants and Southampton Hospital carnival. On the left a "comic" effort—with a "decorated" lorry in the background—and on the right the hull and engine unit of the Supermarine "Sea King"**

FLIGHT

# A STUDY OF AEROPLANE RANGES AND USEFUL LOADS*

BY J. G. COFFIN

## Numerical Analysis

THE essential data for the specific machine used in the calculations are given in Table 1. The total wing and parasite resistances were computed for assumed total weights of 15,000, 13,000, 11,000, 9,000 and 7,000 lbs., respectively.

TABLE 1.—*Summary of total resistances for a machine with a variable load. Area of wing = 1,875 square feet.*

| Weight and wing loading | Speed in m.p.h. | Monoplane $K_y \times 10^4$ | Biplane $K_y$ = ·85 mono. $K_y \times 10^4$ | Monoplane $K_y/K_x$ | Biplane $K_y/K_x$ = ·85 mono. $K_y/K_x$ | Wing resistance = W/Bip. (L/D) | Parasite resistance × 1·10 | Total resistance wing + parasite | Required horse-power |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | lbs. | lbs. | lbs. | |
| 15,000 lbs. or 8 lbs. per square foot | 70·0 | 19·2 | 16·3 | 16·2 | 13·8 | 1,090 | 609 | 1,699 | 318 |
| | 80·0 | 14·9 | 12·5 | 21·2 | 18·0 | 834 | 735 | 1,569 | 334 |
| | 90·0 | 11·6 | 9·9 | 21·7 | 18·4 | 814 | 937 | 1,751 | 421 |
| | 100·0 | 9·40 | 8·0 | 19·6 | 16·7 | 899 | 1,151 | 2,050 | 547 |
| | 110·0 | 7·88 | 6·6 | 16·8 | 14·3 | 1,050 | 1,400 | 2,450 | 719 |
| 13,000 lbs. or 6·92 lbs. per square foot | 60·0 | 22·6 | 19·2 | 9·3 | 7·9 | 1,643 | 475 | 2,118 | 339 |
| | 70·0 | 16·6 | 14·1 | 19·8 | 16·8 | 773 | 609 | 1,382 | 258 |
| | 80·0 | 12·7 | 10·8 | 21·8 | 18·5 | 702 | 735 | 1,437 | 306 |
| | 90·0 | 10·0 | 8·55 | 20·5 | 17·4 | 748 | 937 | 1,686 | 404 |
| | 100·0 | 8·15 | 6·91 | 17·3 | 14·7 | 884 | 1,151 | 2,035 | 543 |
| | 110·0 | 6·72 | 5·71 | 15·0 | 12·7 | 1,022 | 1,400 | 2,422 | 710 |
| 11,000 lbs. or 5·86 lbs. per square foot | 60·0 | 19·2 | 16·3 | 16·2 | 13·8 | 801 | 475 | 1,276 | 204 |
| | 70·0 | 14·1 | 12·0 | 21·5 | 18·3 | 602 | 609 | 1,211 | 226 |
| | 80·0 | 10·75 | 9·15 | 21·3 | 18·1 | 608 | 735 | 1,343 | 286 |
| | 90·0 | 8·48 | 7·23 | 18·2 | 15·5 | 712 | 937 | 1,649 | 396 |
| | 100·0 | 6·90 | 5·86 | 15·2 | 12·9 | 854 | 1,151 | 2,006 | 535 |
| | 110·0 | 5·70 | 4·84 | 13·0 | 11·1 | 996 | 1,400 | 2,396 | 702 |
| 9,000 lbs. or 4·80 lbs. per square foot | 50·0 | 22·6 | 19·2 | 9·2 | 7·8 | 1,152 | 365 | 1,517 | 202 |
| | 60·0 | 15·7 | 13·3 | 20·6 | 17·5 | 515 | 475 | 990 | 158 |
| | 70·0 | 11·5 | 9·79 | 21·6 | 18·4 | 491 | 609 | 1,100 | 206 |
| | 80·0 | 8·82 | 7·50 | 18·6 | 15·8 | 570 | 735 | 1,305 | 278 |
| | 90·0 | 6·97 | 5·92 | 15·4 | 13·1 | 686 | 937 | 1,623 | 390 |
| | 100·0 | 5·66 | 4·80 | 13·0 | 11·1 | 815 | 1,151 | 1,966 | 524 |
| | 110·0 | 4·68 | 3·97 | 11·2 | 9·5 | 946 | 1,400 | 2,346 | 689 |
| 7,000 lbs. or 3·74 lbs. per square foot | 42·7 | 24·0 | 20·4 | 6·6 | 5·6 | 1,250 | 270 | 1,520 | 173 |
| | 50·0 | 17·6 | 14·9 | 18·8 | 16·0 | 439 | 365 | 804 | 107 |
| | 60·0 | 12·3 | 10·4 | 21·8 | 18·5 | 378 | 475 | 853 | 136 |
| | 70·0 | 9·02 | 7·65 | 19·2 | 16·3 | 429 | 609 | 1,038 | 194 |
| | 80·0 | 6·85 | 5·84 | 15·1 | 12·8 | 547 | 735 | 1,082 | 274 |
| | 90·0 | 5·44 | 4·62 | 12·5 | 10·6 | 660 | 937 | 1,597 | 383 |
| | 100·0 | 4·41 | 3·74 | 10·6 | 9·0 | 777 | 1,151 | 1,928 | 514 |
| | 110·0 | 3·64 | 3·09 | 8·4 | 7·1 | 981 | 1,400 | 2,381 | 698 |

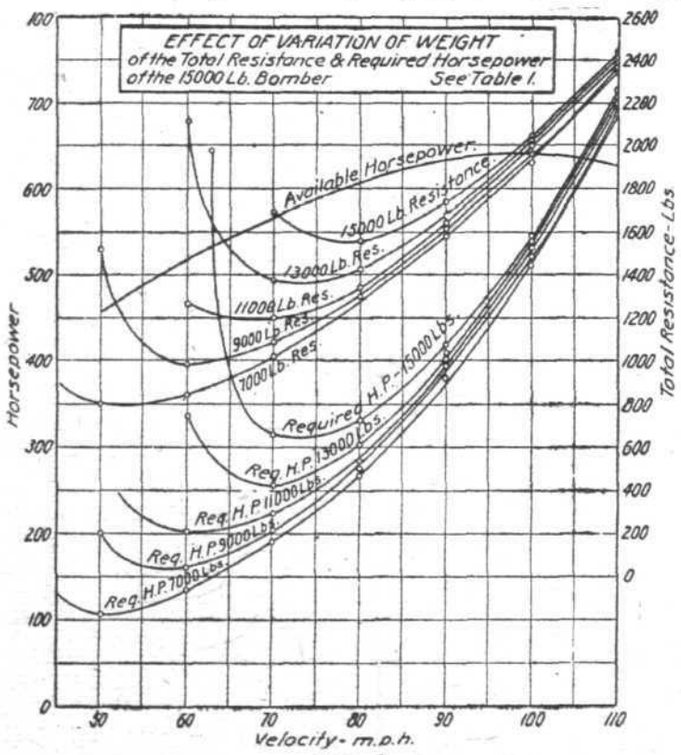



Fig. 1

The total resistance and required horse-power curves were then plotted against speed in the usual manner. See Table 1 and Fig. 1.

* Part I of U.S. Advisory Committee for Aeronautics Report No. 69.

### *Conditions for Maximum Range*

It is evident that the *work* required to fly a given distance, being the product of the total resistance, or required propeller thrust, by the distance, is least when the thrust is kept at its minimum values. The points of minimum drag were, therefore, located on the resistance curves. These points determined the most economical speeds and the corresponding required powers. The powers thus determined are seen not to be minimum powers. The minimum powers are but slightly less than those corresponding to minimum resistance, and occur at speeds slightly less than minimum resistance speeds. The minimum power is that for which the fuel consumption is least for a given *time*, and, as it turns out, is not the most economical power for flying the greatest distance.

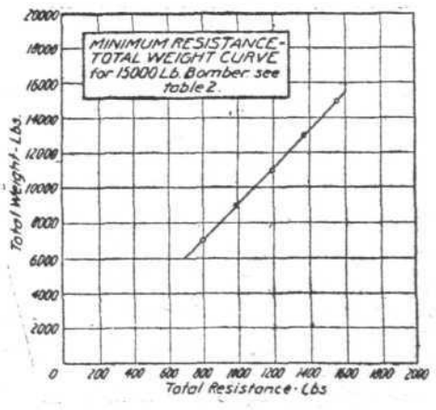



Fig. 2

The speed corresponding to minimum power is the speed at which a machine should fly in order to remain aloft the greatest possible time.

In Fig. 2 the weight of the machine is plotted against minimum resistance. The curves in Figs. 1 and 2 show that—

1. The maximum range speeds decrease as the load

decreases. The 'plane must fly slower and slower as the load diminishes.

2. The maximum range powers decrease as the load decreases.

3. These powers are not minimum powers, but are slightly greater, and correspond to greater speeds than least power speeds.

4. The total air resistances decrease almost in exact proportion to the weight of the plane.

### *Fuel Consumption*

The fuel consumption at maximum brake horse-power output is taken as 0·6 lb. per horse-power hour, and for any reasonable throttled condition this number is increased to 0·7.

The available horse-power curve was obtained in the usual manner by assuming proper propeller efficiencies at slow and high speeds and multiplying these into the available brake horse-power. The fuel consumption per horse-power delivered by the propeller can therefore be computed by dividing the fuel consumption per brake horse-power of the motor by the propeller efficiency at that speed, or, what is the same thing, multiplying 0·6 by 800 and dividing by the available horse-power at that speed. As mentioned above, these results are multiplied by $\frac{0\cdot7}{0\cdot6}$ in order to compensate for a slight loss of efficiency under throttled conditions. This

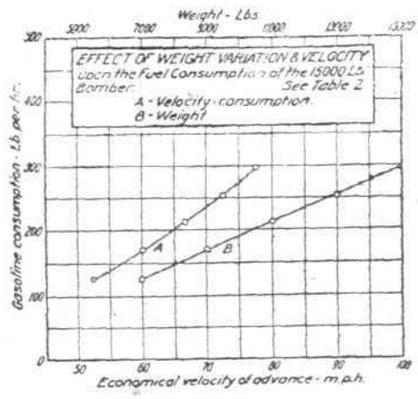



**Fig. 3**

TABLE 2.—*Gas consumption in lbs. per hour at the economical speed*

| Weight of machine | Minimum total resistance | L/D, or weight/total resistance | Corresponding speed in miles per hour | Corresponding horse-power: Required | Corresponding horse-power: Available | Gasoline consumption, $0\cdot7 \times 800$ in avail. h.p. lbs. per h.p. | Total gasoline consumption per hour |
|---|---|---|---|---|---|---|---|
| lbs. | lbs. | | | | | | lbs. |
| 15,000 | 1,560 | 9·62 | 77·5 | 320 | 603 | 0·927 | 296 |
| 13,000 | 1,372 | 9·47 | 72·5 | 265 | 583 | 0·960 | 254 |
| 11,000 | 1,195 | 9·22 | 66·7 | 212 | 555 | 1·009 | 214 |
| 9,000 | 992 | 9·08 | 59·6 | 159 | 517 | 1·082 | 172 |
| 7,000 | 795 | 8·82 | 52·5 | 107 | 472 | 1·187 | 127 |

TABLE 2A.—*Gas consumption in lbs. per hour at the maximum speed*

| Weight of machine | Minimum total resistance | L/D, or weight/total resistanee | Corresponding speed in miles per hour | Corresponding horse-power: Required | Corresponding horse-power: Available | Gasoline consumption, $0\cdot6 \times 800$ in avail. h.p. lbs. per h.p. | Total gasoline consumption per hour |
|---|---|---|---|---|---|---|---|
| lbs. | lbs. | | | | | | lbs. |
| 15,000 | 2,265 | 6·63 | 105·4 | 636·0 | 636·0 | 0·755 | 480 |
| 13,000 | 2,260 | 5·75 | 105·9 | 635·5 | 635·5 | 0·755 | 480 |
| 11,000 | 2,245 | 4·91 | 106·3 | 635·0 | 635·0 | 0·756 | 480 |
| 9,000 | 2,225 | 4·05 | 106·8 | 634·9 | 634·9 | 0·756 | 480 |
| 7,000 | 2,225 | 3·15 | 106·8 | 634·8 | 634·9 | 0·756 | 480 |

TABLE 2B.—*Ratios of L/D and angles of incidence for maximum range*

| Loading lbs./sq. ft. | Biplane L/D. | Velocity miles per hour | Biplane, $K_y \times 10^4$ | Monoplane, $K_y \times 10^4$ | Angle of incidence degrees |
|---|---|---|---|---|---|
| | | *Maximum Range Speeds.* | | | |
| 8·00 | 15·55 | 77·5 | 13·3 | 15·65 | 5·3 |
| 6·92 | 15·63 | 72·5 | 13·2 | 15·55 | 5·2 |
| 5·86 | 15·63 | 66·7 | 13·15 | 15·50 | 5·2 |
| 4·80 | 15·38 | 59·6 | 13·5 | 15·90 | 5·45 |
| 3·74 | 15·30 | 52·5 | 13·55 | 15·95 | 5·5 |
| | | *High Speed* | | | |
| 8·00 | 14·45 | 105·4 | 7·15 | 8·41 | 1·75 |
| 6·92 | 13·17 | 105·9 | 6·18 | 7·27 | 1·25 |
| 5·86 | 11·65 | 106·3 | 5·17 | 6·07 | 0·7 |
| 4·80 | 10·03 | 106·8 | 4·21 | 4·95 | 0·2 |
| 3·74 | 3·06 | 106·8 | 3·28 | 3·86 | —·35 |

TABLE 3.—*Time-weight variation computation for speeds Maximum Range*

| Initial weight of machine in lbs. | Thrust in lbs. | Velocity in miles per hour | Gasoline consumed, lbs. per hour | Distance, miles: S = Vt. | Distance, miles: Total | Gasoline consumed in interval (lbs.) | Time in hours |
|---|---|---|---|---|---|---|---|
| 15,000 | 1,560 | 77·5 | 297 | 155·0 | 155 | 594 | 2 |
| 14,406 | 1,500 | 76·3 | 286 | 152·6 | 307·6 | 572 | 4 |
| 13,834 | 1,450 | 74·9 | 273 | 149·8 | 457·4 | 546 | 6 |
| 13,288 | 1,403 | 73·3 | 261 | 146·6 | 604·0 | 522 | 8 |
| 12,766 | 1,355 | 71·3 | 250 | 142·6 | 746·6 | 500 | 10 |
| 12,266 | 1,305 | 70·5 | 240 | 141·0 | 887·6 | 480 | 12 |
| 11,786 | 1,265 | 69·0 | 230 | 138·0 | 1,025·6 | 460 | 14 |
| 11,326 | 1,225 | 67·5 | 220 | 135·0 | 1,160·6 | 440 | 16 |
| 10,886 | 1,185 | 66·2 | 210 | 132·4 | 1,293·0 | 420 | 18 |
| 10,466 | 1,145 | 64·7 | 201 | 129·4 | 1,422·4 | 402 | 20 |
| 10,064 | 1,110 | 63·5 | 193 | 127·0 | 1,549·4 | 386 | 22 |
| 9,678 | 1,065 | 62·2 | 184 | 124·4 | 1,673·8 | 368 | 24 |
| 9,310 | 1,030 | 61·0 | 177 | 122·0 | 1,795·8 | 354 | 26 |
| 8,956 | 995 | 59·7 | 169 | 119·4 | 1.915·2 | 338 | 28 |
| 8,618 | 965 | 58·6 | 162 | 117·2 | 2,032·4 | 324 | 30 |
| 8,294 | 930 | 57·4 | 155 | 114·8 | 2,147·2 | 310 | 32 |
| 7,984 | 900 | 56·3 | 148 | 112·6 | 2,259·8 | 296 | 34 |
| 7,688 | 872 | 55·1 | 142 | 110·2 | 2,370·0 | 284 | 36 |
| 7,404 | 840 | 54·1 | 136 | 108·2 | 2,478·2 | 272 | 38 |
| 7,132 | 815 | 53·3 | 132 | 106·6 | 2,584·8 | 264 | 40 |

The maximum possible range is seen to be 2,480 miles under these conditions.

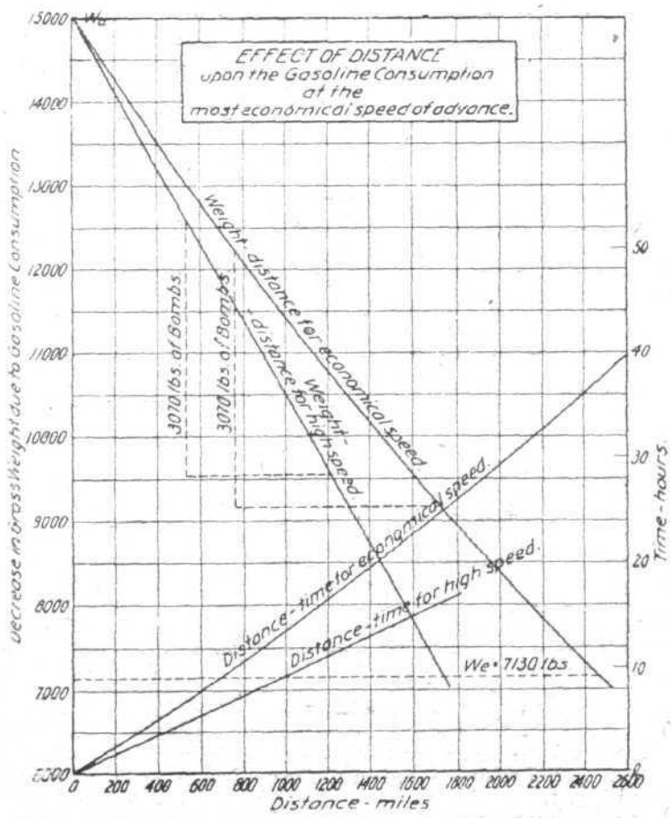



**Fig. 4**

procedure corresponds to experimental tests, and, if anything, probably overestimates the fuel consumption.

With these data Table 2 and Fig. 3 were made. The fuel consumption is seen to be proportional to the weight.

Fig. 4 shows a curve giving the relation between the weight at any time and the corresponding distance flown. Starting with a full fuel load of 7,870 lbs., giving a total weight of 15,000 lbs., the machine was assumed to travel for a given

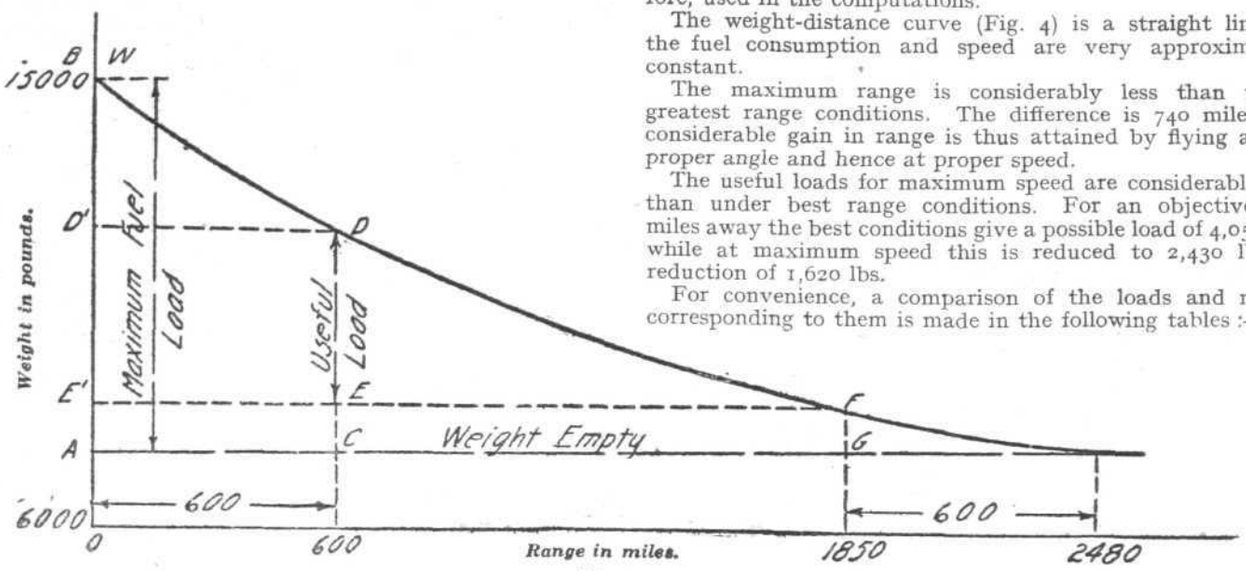



Fig. 5.

time interval (two hours) at the weight, speed, gas consumption, and thrust corresponding to that weight. During the next two hours it was assumed to fly at new values corresponding to the new weight, which is equal to the old weight less the fuel consumed in the preceding time interval, and so on.

*Determination of the Maximum Load for a Given Objective*

Evidently in case a return trip is to be made without refuelling the greatest distance for an objective is equal to or less than half this greatest range. It is easy to determine the greatest possible useful load by means of the weight-distance curve, Fig. 5, in the following way :—

Suppose the objective is 600 miles distant. It requires AB–CD lbs. of fuel to get there and GF lbs. to get back after the load is deposited. Since the maximum load is AB lbs. there will be left DE or D'E' lbs. for useful load. Calling the maximum range S, project the points on the curve

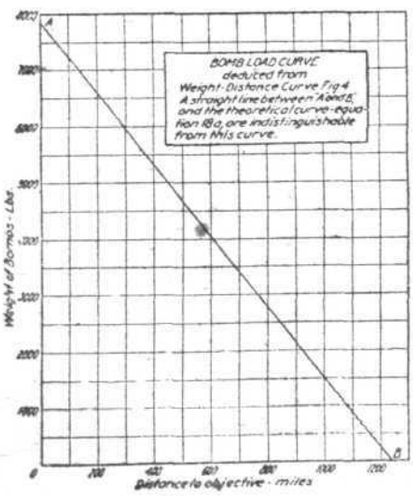



Fig. 6.

for $s = 600$, point D, and $s = S - 600$, point F, on the weight axis, the weight included between these two points is the maximum load for that objective. This procedure is quite general. The load decreases to zero as the objective distance increases to half the maximum range, and increases to the maximum load as the objective distance decreases to zero.

A curve (Fig. 6) was determined by this method for this machine which gives directly the maximum useful load for any objective. This curve turns out to be practically a straight line. A proof that it should be very approximately straight is given in Part II.

*Consequences of Flying at Maximum Speed*

In Table 2A the results for flight at maximum speed are tabulated. The gas consumption is constant and the speed of advance was found to be constant to within about 1 per cent. The average value, 106·2 miles per hour, was, therefore, used in the computations.

The weight-distance curve (Fig. 4) is a straight line, as the fuel consumption and speed are very approximately constant.

The maximum range is considerably less than under greatest range conditions. The difference is 740 miles. A considerable gain in range is thus attained by flying at the proper angle and hence at proper speed.

The useful loads for maximum speed are considerably less than under best range conditions. For an objective 600 miles away the best conditions give a possible load of 4,050 lbs. while at maximum speed this is reduced to 2,430 lbs., a reduction of 1,620 lbs.

For convenience, a comparison of the loads and ranges corresponding to them is made in the following tables :—

TABLE 4

| Hours of fuel full open | Bombing load in lbs. | Range at maximum speed | | Range at best speed | | Difference in miles | |
|---|---|---|---|---|---|---|---|
| | | Total | Objective | Total | Objective | Total | Objective |
| 10 | 3,070 | 1,060 | 530 | 1,510 | 755 | 450 | 225 |
| 7½ | 4,270 | 790 | 395 | 1,130 | 565 | 340 | 170 |
| 4 | 5,950 | 420 | 210 | 610 | 305 | 190 | 95 |

TABLE 5.

| Hours of fuel full open | Range | | Bombing load maximum speed | Bombing load best speed | Difference in lbs. |
|---|---|---|---|---|---|
| | Total | Objective | | | |
| 10 | 1,510 | 755 | 1,030 | 3,070 | 2,040 |
| 7½ | 1,130 | 565 | 2,738 | 4,270 | 1,532 |
| 4 | 610 | 305 | 5,090 | 5,950 | 860 |

For the shorter flights the differences decrease, but they are considerable in all cases. The bombing load is increased by almost 190 per cent. for maximum range speeds over maximum speed conditions for 10 hours' fuel.

*Flying at Minimum Power*

The gas consumption at minimum power is practically identical with that at best range power. While the minimum power is slightly less than the power for best range speed, the speed is also less and the propeller efficiency is also slightly less. The net result is that the time of flight is about the same and the maximum range is diminished.

A calculation of the range at minimum power gives 2,400 miles, instead of 2,480 miles.

For flight at minimum power the angle of attack is practically constant and slightly greater than that for best range speed.

*Time Required for any Range*

For convenience, the curves of elapsed time for any distance flown are given in Fig. 4 for both best range speeds and maximum speed conditions. By means of them the time of going and returning from any given objective may be read off. In particular, it is seen that the maximum time of flight under high-speed is 16·4 hrs., as against 38·0 hrs. for best range speed.

For a bombing raid on an objective at 600 miles, the total elapsed time to go and return is for maximum speed 11·25 hrs., and for best range speed 18·65 hrs. It will be seen in the following how this time difference may be decreased by flying at high altitudes without changing the efficiency for best range conditions.

*(To be Continued)*

# THE ROYAL AIR FORCE

*London Gazette, October 29*

*Permanent Commissions*

Flying Officer B. V. S. Smith, M.C., A.F.C. (half-pay list), resigns his permanent commn.; Oct. 30.

*Short Service Commissions.*

Flying Officer R. W. Godfrey resigns his short service commn; Oct. 30. Pilot Officer G. E. Newton is granted a short service commn. as a Flying Officer; Oct. 18 (substituted for *Gazette*, March 30). Notification in *Gazette* of Aug. 24, concerning Obs. Officer R. A. Brunton, M.C., is cancelled. Flying Officer C. E. Amoore resigns his short service commn.; Oct. 30.

*Flying Branch*

Flying Officer C. L. King, M.C., D.F.C., is placed on Half-pay List, scale (B); Oct. 22.

*The following relinquish their R.A.F. commns., on appointment to the T.F., and are permitted to retain their rank.*—Lieut. A. Blomfield, Sec. Lieut. A. G. E. Briggs, Lieut. A. E. Ealding. Sec. Lieut. (Hon. Lieut.) R. M. Williams relinquishes his R.A.F. commn. on appointment to the T.F., and is permitted to retain rank of Lieut. Lieut. (Hon. Capt.) (Actg. Capt.) J. F. Davison relinquishes his R.A.F. commn., and is permitted to retain rank of Capt. Capt. E. M. Morgan relinquishes his R.A.F. commn., and is permitted to retain his rank. Sec. Lieut. L. C. Baker relinquishes his R.A.F. commn., on ceasing to be employed.

*The following are transfd. to the Unemployed List.*—Lieut. W. M. Shoosmith; Oct. 11, 1919 (*Gazette*, Aug. 27 to stand). Lieut. J. S. Middleton; Oct. 10. Lieut. G. R. Edwards; Oct. 13. Lieut. (Hon. Capt.) G. M. Puckridge; Oct. 14. Lieut. F. Cave-Brown-Cave; Oct. 16. Lieut. S. Moyles; Oct. 21.

*Administrative Branch*

*The following are transfd. to the Unemployed List.*—Lieut. J. C. Nairn; Jan. 1. Lieut. J. R. Brown; Oct. 14. Capt. D. S. R. Kent; Oct. 17. Lieut. C. P. V. Roche; Oct. 20.

*Technical Branch*

Maj. T. B. Hornblower relinquishes his R.A.F. commn. on appt. to the T.F., and is permitted to retain his rank.

*The following are transfd. to the Unemployed List.*—Lieut. W. W. Scott-Davidson; Sept. 15. Lieut. S. Empsall; Oct. 12. Capt. J. M. Auger, Lieut. G. M. Roberts, Capt. N. H. Wood; Oct. 13. Lieut. C. R. Brown, Oct. 14. Maj. V. C. Richmond, O.B.E.; Oct. 14. Lieut. C. P. Brown, Lieut. V. W. G. Day, Lieut. W. H. E. Thomas, Lieut. C. L. Whitburn; Oct. 16.

Notification in *Gazette*, Feb. 3, concerning Lieut. L. C. Bygrave, M.B.E., is cancelled (*Gazette*, July 13 to stand).

*Memoranda*

Lieut.-Col. (Actg. Brig.-Gen.) C. G. Hoare, C.M.G. (Maj., Ind. Army), relinquishes his R.A.F. commn. on ceasing to be employed; May 24, 1919 (substituted for *Gazette*, July 15, 1919). Hon. Lieut. A. H. Fox relinquishes his hon. R.A.F. commn. on ceasing to be employed; Oct. 13. Capt. (actg. Wing Commdr.) G. W. Parkinson, M.C., is transfd. from S.O. to Unemployed List; Nov. 15, 1919.

Four Cadets are granted hon. commns. as Sec. Lieuts. with effect from date of their demobilisation.

Overseas Cadet 35 G. T. Carter is granted an hon. commn. as Sec. Lieut., with effect from the date of his demobilisation.

# ROYAL AERONAUTICAL SOCIETY NOTICES

*Lectures.*—The next meeting will commence at 5 p.m. instead of the usual 5.30 p.m. at the Royal Society of Arts, on Thursday afternoon, November 18—the day following the Annual Dinner. Air Vice-Marshal Sir E. L. Ellington, K.C.B., C.M.G., C.B.E., Director-General of Supply and Research, will take the Chair. The paper will be "The Problem of the Helicopter," by M. Louis Damblanc.

*Annual Dinner.*—A considerable number of tickets for the Annual Dinner have already been sold, and early application for the remaining places is therefore desirable. Tickets will be forwarded to those members who have already applied as soon as these are received from the printers. Members will assist the Secretary in arranging the seating accommodation if they will notify him of any arrangements for forming parties. The price of the dinner has been fixed at one guinea per head exclusive of wines.

*Library.*—The Council desire gratefully to acknowledge the gift of a bound copy of the Report of the Steel Research Committee which has been placed in the Library. It is desired to inform members that copies of this Report may be obtained from the Steel Research Committee, 28, Victoria Street, price 31*s.* 6*d.* (less 33⅓ per cent. if applied for before November 27).

The following book has also been placed in the Library:—"A Treatise on Airscrews," by W. E. Park.

W. LOCKWOOD MARSH

# CORRESPONDENCE

*The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.*

## AIRWORTHINESS CERTIFICATES

[2032] At the recent Air Conference I referred to the fact that airworthiness certificates issued by the Air Ministry could not be relied upon by insurance companies when writing aircraft risks, and, in consequence, machines offered for insurance had to be re-surveyed by their experts before the risk was accepted.

This statement has been received by certain departments of the Air Ministry with an amount of ill-feeling, although I anticipated that they would welcome a criticism which might be the means of bringing these departments into closer touch with each other, with a view to improving the situation and ensuring a higher degree of safety in civilian machines.

The present system of issuing airworthiness certificates appears to be very unsatisfactory, and would probably lead to disaster if outside influence was not brought to bear in securing greater airworthiness of machines, namely, by the survey carried out by insurance companies' experts.

It appears that, although a machine may be considered defective in design by Government inspectors who are deputed by the Inspection Department to finally inspect the machine for workmanship and material, that department have no authority to refuse the issue of an airworthiness certificate. The result is that, in carrying out surveys for the insurance companies which I act for, I have been compelled to recommend the non-insurance of a number of machines until, in some cases, considerable alterations have been made, although the owner is in possession of a so-called airworthiness certificate.

In the case of sales of surplus Government machines, the machines are not inspected by Air Ministry inspectors, although the C.G.C.A. issues to the purchaser an airworthiness certificate with each machine.

This system of issuing airworthiness certificates is a danger to the public, and immediate action should be taken to ensure that all machines are properly inspected, and approved as a whole, by qualified engineers (not Wartime productions), prior to certificates being issued, and that the expense of such expert inspection be borne by the owner of the aircraft, and not, as is now the case, by the taxpayer.

Another important point, which, in the interest of the flying public, must receive attention, is the question of ensuring that machines are maintained in an airworthy condition after the issue of the airworthiness certificate. Under present arrangements, a machine is supposed to receive an inspection by a ground engineer before each flight. This is satisfactory so far as it goes, but the weak link in the chain is the position of the man who carries out this inspection. He certainly holds an A.M. certificate, but, at the same time, is the servant of the aircraft owner, and is, in consequence, liable to dismissal should be make himself too aggressive in his demands for renewals or repairs. His position is therefore invidious and lacking in authority.

The future of civil aviation depends to a large degree upon the safety and reliability of machines, and until something is done to ensure this end, the present half-hearted confidence of the public will continue, and insurance premiums will still figure heavily in running charges.

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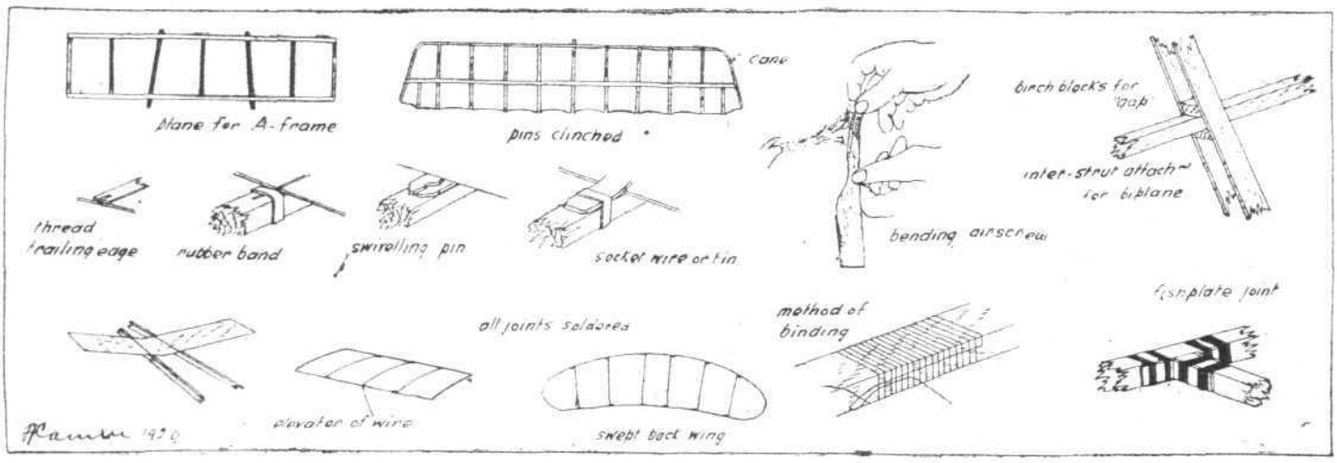
FLIGHT

# MODEL AEROPLANES


NOTE.—*All communications should be addressed to the Model Editor. A stamp should be enclosed for a postal reply*

I SHOW this week some details of construction—mainly because of the number of queries I receive from new readers. Readers asking for information often forget that early issues of FLIGHT are available in most public libraries, which they could consult to settle their queries. Many queries (of course, not all of them) relate to subjects previously dealt with in FLIGHT, and whilst we are always pleased to assist readers in every way possible, it is obviously out of the question to constantly publish information previously given herein. Where such queries overlap, I usually state the issue dealing with that subject, or else send a cutting of the article. Will readers bear this in mind when writing to me?




*Planes.*—Two materials are available for use in building model planes, namely, wood (including bamboo) and steel wire, under which head I also include umbrella ribbing. These materials are sometimes combined in the same plane, the wood being used for the spars in order to obtain stiffness, and wire for the ribs. There is, however, a difficulty in making a satisfactory joint between wood and wire from the point of view of neatness and strength, and it is better to use either all wood or all wire.

The design of the framework of the aerofoil is always a simpler matter than the rest of the machine. In machines driven by rubber they are single ribbed and also single surfaced. An aerofoil with a cane or bamboo leading edge is shown in the drawing, bent to form the end ribs. This arrangement gives an improved lift to the wing tip. The other plane shown is suitable for A-frames, and two ribs triangularly disposed and with extensions are provided for attachment to the mainspar. The trailing edge of the plane with the bamboo leading edge is of thread, attached to each rib in the manner shown by the small detail drawing. The thread and the wood may be wetted with thin glue, to hold it in place until the fabric is attached.

*Plane Attachments.*—With regard to the attachment of the plane to the framework or *fuselage* (and there are many), I show some of the most widely favoured—used alike in America and England and Holland, and which I can thoroughly recommend.

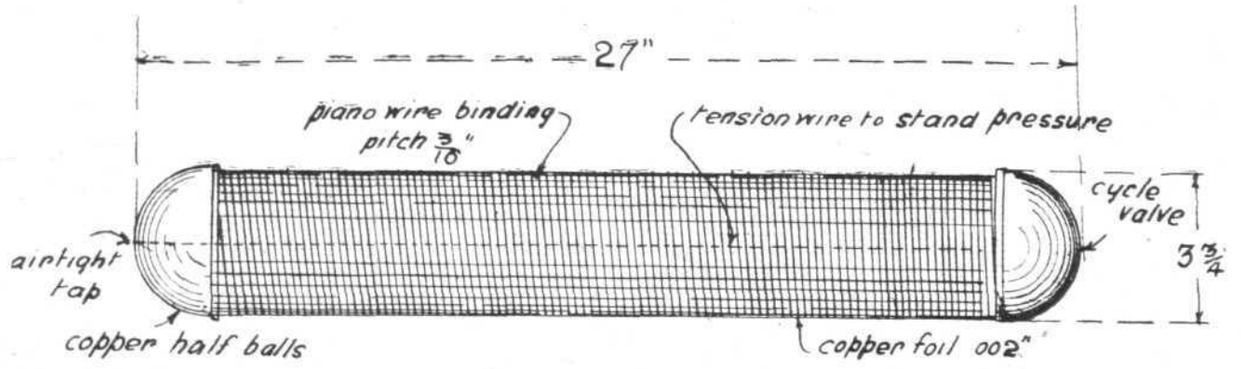
The chief considerations with regard to such attachments are that they must allow of the plane being attached and detached quickly, they must be strong, and must hold the plane firmly in place. The swivelling pin device is one used on many of Mr. Twining's machines. This bears on an extension of the centre rib. The other attachment consists of a band of tin or wire encircling the spar and fitting just tight enough to hold securely over the end of the rib.

Planes made of steel wire over 18 ins. span are not sufficiently rigid to be efficient in a breeze. One advantage, however, which accrues from the use of wire is that any curves which it is desired to impart can easily be made. The wire should be of the piano variety. A method of fastening wire planes to wooden spars is shown in the drawing. The wire of the centre rib is bent downwards into the spar. Over this extension a stout rubber band is rolled.

*Elevators.*—These should be made of piano wire, although in very small machines wooden elevators, attached by means of rubber bands may effectively be used. This form of elevator was used in the early days by Mr. Cyril Ridley. The other details here shown are sufficiently clear, I think, to render a textual reference unnecessary.

### Compressed-air Containers

COMPRESSED air containers are constructed of thin copper or brass foil about .002 in. in thickness, obtainable from Stanton Bros., 73, Shoe Lane, London, E.C.4. The ends are half-balls, which are obtainable from the same source. A wooden former of a diameter equal to the interval diameter of the half-balls will be required round which to wrap the foil to ensure that the tube or cylinder thus formed exactly fits the half-balls. Half an inch should be allowed for lapping, and the face of the edges in contact should be lightly tinned. Fold the foil tightly round the wooden former and tie in



place with string. Flow some resin or Fluxite along the seam and close the seam with solder. On no account use spirits of salts as a flux.

While still on the wooden former, the container-body is to be wound with 30 S.W.G. piano wire, the pitch of the spiral solutions being $\frac{3}{16}$ in. The reason for such binding is self-evident—it prevents the container bursting under pressure.

Having finished the winding (which is soldered to the foil at every revolution, and is, moreover, pulled quite tightly round it) and before withdrawing the former, one of the half-balls may be soldered to the cylindrical shell—of course, tinning the faces in contact as before. The airtight tap and valve should be fixed to the half-balls prior to the assembly of the latter to the cylinder.

To the inside of one of the half-balls (the final one to be attached) a 26 S.W.G. tension wire is soldered. Withdrawing the wooden former, the tension wire should be passed through the container and its end threaded through a hole previously drilled in the half-ball first attached. Apply a little tension, working the loose half-ball into position inside the cylinder, and while still pulling on it solder it into the hole.

Now solder the second half-ball into place (remembering to have tinned the surfaces before fixing them), letting the solder flow well into the joint.

Test the container for leaks in a bath of paraffin.

# LEGAL INTELLIGENCE

### The Aeronautical Institute

AT Bow Street Police Court on November 6th, Sir Chartres Biron concluded the hearing of the summons against Lucien Blin Desbleds and Colonel Frederick Natusch Maude, C.B., for carrying on business as the Aeronautical Institute of Great Britain at Lincoln's Inn Fields, without having furnished particulars as required by the Registration of Business Names Act, 1916.

In announcing his decision, the Magistrate said that the only question he had to determine was whether or not the institute had been run for profit. It had been suggested that the shareholders' interests were not protected, but none of the shareholders had ever objected, and if they had asked for a meeting one would have been held. There was very little evidence for the prosecution that the institute had been run for profit, and he was now satisfied that this had not been the object. He dismissed the summons, and ordered the Board of Trade to pay each of the defendants £5 5s. costs.

Mr. Burrows, who appeared for the Board of Trade, protested against an order for costs.

The Magistrate remarked that if the Board of Trade chose to take proceedings and failed they must pay the same as everyone else.

# COMPANY MATTERS

### Allen-Liversidge

THE businesses of Allen-Liversidge, Imperial Light and the Dissolved Acetylene Company, have been amalgamated under the name of Allen-Liversidge, whose nominal share capital is now £300,000, of which £193,720 has been issued and fully paid. Messrs. A. W. Fox and C. H. W. Mander, directors of the Dissolved Acetylene Company, and Messrs. A. Akers and E. W. Sprott, directors of Imperial Light, have jointed the Board of Allen-Liversidge.

Mr. E. W. Sprott, managing director of Imperial Light, becomes one of the joint managing directors of Allen-Liversidge, in addition to Messrs. T. G. Allen and P. B. Liversidge, who have been joint managing directors since the incorporation of the company.

### NEW COMPANIES REGISTERED

AIR NAVIGATION CO. (SCOTLAND), LTD., 210, St. Vincent Street, Glasgow.—Capital £2,500, in 2,000 shares of £1 each and 2,000 shares of 5s. each. Acquiring business of the Air Navigation Co., aeronautical engineers. First directors: C. P. Jenkyns and R. W. Collins.

GIRDER FRAMEWORKS, LTD., Bank Chambers, 30A and 31, St. Paul's Churchyard, E.C. 4.—Capital £100, in £1 shares. To enter into contracts with H.M. Government and others for the purchase of aeroplane hangars and similar property; to manufacture and deal, etc., in building materials. First directors: C. H. Clemetson and L. R. Richards.

### Fokker Migrating to the States

FROM a note in the Amsterdam *Courant* it would appear that Mynheer Fokker has decided to transfer his activities from Holland to America. The reason given for leaving Holland is failure to conclude contracts with the Dutch Government necessary to enable him to keep his new Dutch aeroplane works running. the Dutch Government preferring to give orders to British firms for a number of De Havilland and Avro aeroplanes.

### PUBLICATIONS RECEIVED

*The Motor, Marine and Aircraft Red Book*, 1920. Compiled by W. C. Bersey and A. Dorey. London: The Technical Publishing Co., Ltd., 1, Gough Square, Fleet Street, E.C. 4. Price 21s. net; by post 22s.

*Report No.* 82. *Airplane Stress Analysis. Also Table of Gears from Captured Engines.* National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

*Report No.* 92. *Analysis of Wing Truss Stresses, including the Effect of Redundancies.* National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

*Technical Note No.* 18. The Dynamometer Hub. By W. Stieber. National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

*The D.U. Technical Series. A Treatise on Airscrews.* By W. E. Park, A.R.C.Sc. London: Chapman and Hall, Ltd. Price 21s. net.

*Dynamics of the Aeroplane.* By Rene Devillers. London: Translated by Capt. Wm. John Walker, R.A.F. London: E. and F. N. Spon. New York: Spon and Chamberlain. Price 21s. net.

*The Complete Airman.* By G. C. Bailey. London: Methuen and Co., Ltd. Price 16s. net.

### AERONAUTICAL PATENT SPECIFICATIONS

*Abbreviations:* cyl. = cylinder; I.C. = internal combustion; m. = motors

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

**APPLIED FOR IN 1919**

*Published November* 4, 1920

11,190. SOC. ANON. DES FILATURES CORDERIES ET TISSAGES D'ANGERS. Shelter for aeroplanes of great length of wing. (131,872.)
14,360. A. H. R. FEDDEN, L. F. G. BUTLER and COSMOS ENG. CO. Cylinders for light engines. (152,066.)
16,683. D. J. MOONEY and F. B. UNDERWOOD. Metal fittings for aircraft. (152,085.)
16,703. S. G. BROWN. Gyro-compasses. (152,090.)
16,979. F. M. DEAN. Speed-indicators and recorders for aircraft. (152,119.)
17,212. R. MARSHALL. Control of aircraft. (152,125.)
17,350. A. ORLANDI. Aeroplanes. (152,129.)
23,252. R. ORR. Air engines. (152,187.)
28,825. G. A. ROSSITER. Gyro-compass. (152,226.)
29,665. S. H. HOLLANDS. Aerial propellers. (152,233.)

*Published November* 11, 1920

14,780. S. V. DE BOLOTOFF. Silencers for I.C. engines. (152,385.)
17,626. W. Y. CARLIN. Inclinometer. (152,425.)
18,484. D. V. HOTCHKISS. Propulsion of aircraft, etc. (152,449.)
20,821. A. L. STROUT. Automatic stabiliser. (152,476.)
22,212. C. F. PARKINSON. Inclinometer. (152,488.)

**APPLIED FOR IN 1920**

*Published November* 4, 1920

18,068. R. RAUTENBACH. Aluminium pistons. (145,740.)

*Published November* 11, 1920

366. C. TONIOLO and OFFICINE ELETTROCHIMICHE DOTTOR ROSSI. Process for production of hydrogen. (152,554.)



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